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THE LOCAL DIAGNOSTIC VALUE OF THE TUNING-FORK TESTS.

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All the functional tests of the ear, including those of the tuning fork, have a double purpose: (1) to fix the grade, and (2) the locality of the disease.

I shall here discuss only the second, namely, what are the conclusions to be deduced from the results of the tuning-fork tests with respect to the local diagnosis?

The commonly accepted principles for the local diagnosis are the sequences:

1. When the conducting apparatus is diseased, the lower tones are impaired or entirely lost, and the bone conduction is increased.
2. When the perception apparatus is diseased the power of hearing high tones is lost, and bone conduction is shortened.[1]

The physiological basis of these principles are two commonly accepted hypotheses, namely:

1. In case of air conduction, for the perception of the higher tones the conducting apparatus is not necessary, because they can be taken up by means of "molecular vibration."
2. In case of bone conduction the vibrations of the tuning fork act directly on the labyrinth, so that in this case we can examine directly the perception apparatus.

(1) See Adair Dighton's Manual, p. 25, and W. Lincoln Ballenger: Disease of the Nose, Throat and Ear, p. 585.

As we see, all our conclusions relating to the local diagnosis are based upon the physiological conception of the air conduction and bone conduction. But if we examine this question in detail, we can see that this part of the physiology is not very clear and the explanations are not at all in accord. On the contrary, we find in this question such differing opinions, some of them erroneous, so that they afford no sure basis for the local diagnosis.

Therefore, I think we must first try to reconcile all these different physiological opinions in order to have a fixed basis for further deductions.

This I attempted to do in my study, "Zur Physiologie der Knochenleitung," submitted to the Congress of the Deutsche Otologische Gesellschaft at Kiel in the year 1914.

As I cannot cite the papers of the Congress, the publication of which was hindered till now (at least in our country) by the war, and which, therefore, I must consider as quite unknown, I must ask the reader's permission to repeat briefly the train of thought exhibited in that study.

This is not only an abstract question of physiology, but it has great practical importance, for it is the only way to exclude the erroneous physiological bases, to avoid diagnostical errors, and to find the true methods of treatment. It is important not only for the ear specialists but for every surgeon. I agree with Kobrak[2] who says that the three tuning forks are tools as indispensable for the consulting room, as is the eye mirror.

The adequate stimuli of the auditory nerve are firstly the sound waves of the air, induced by the vibrations of tone-producing bodies. These waves are taken up by the conducting apparatus. This is the way of *air conduction* (aerotympanal route).

Secondly, we can accept as stimuli those vibrations of the tone-producing bodies which are directly communicated to our body. This is the way of *bone conduction*. It seems to be natural that these vibrations, in whatever way they reach the labyrinth, must produce the same physical effects, as the end organ of the cochlear nerve can have only one kind of stimulus. But we commonly accept a twofold stimulus, one for the air conduction and one for the bone conduction. Moreover, in the air conduction we make a distinction for the stimulus of the lower tones and for that of the higher tones. To elucidate these questions, let us first consider the route of the air conduction.

(2) A. Jansen und F. Kobrak: Praktische Ohrenheilkunde, Berlin, 1918.

I. "The sound waves conducted from the air impinge upon the membrana tympani, producing vibrations in it. These vibrations conducted along the chain of ossicles transmit impulses to the intralabyrinthine fluid through the medium of the foot plate of the stapes;" Shambaugh's words quoted by Ballenger. As the fluid is practically incompressible, and as there is no other way for the fluid to evade the pressure, the foot plate can only be pressed into the oval window if at the same time the elastic membrane of the round window is pushed outwards. This fact was experimentally proved by Tröltsch.[3]

The impulses originating in the perilymph are wave like motions, the direction of which ascends through the scala vestibuli, through the helicotrema, then descends the scala tympani to the round window. Up to this point there is no difference of opinion as to the physiology of air conduction. As to the manner in which the wave like motion of the perilymph acts on the end organ, there are different opinions, but they are not vital to the present question. For my part, I accept Shambaugh's theory, as follows:

This motion in the scala vestibuli acts through the membrane of Reissner to the endolymph, "where sympathetic vibrations are imparted to the several parts of the membrana tectoria (sei Corti) depending on the pitch of the tone. The vibrations in turn stimulate the hairs of the Corti's cells," the end apparatus of the acoustic nerve.

The pathological fact, that in the case of middle-ear diseases the perception of the higher tones are not impaired, is the basis of the opinion that for the perception of the higher tones there must be another way. Bezold was the first to remark that the drum serves only for the perception of the lower tones. This opinion of Bezold was later generalized too far, as in the text-books we find it commonly accepted, that "the sound-conducting apparatus is not necessary for the perception of the higher tones."

But when these pioneers of otology speak of the conducting apparatus they all understand thereby the membrana tympani and ossicular chain, but none of them thinks of the two windows. If we reckon as conducting apparatus also the two windows, the function of which is always necessary for hearing the high tones, we must not make a distinction between the perception of the lower and higher tones in the case of air conduction.

(3) Lehrbuch, 1887, p. 171.

The vibrations of the lower tones are of such amplitude, that without the transformation of the membrana tympani and ossicles they cannot be perceived, but the shorter vibrations of the higher tones can be taken up directly from the footplate, which acts in this case like a telephone membrane. The end result is the same in both cases, the footplate produces the above mentioned wave-like motions in the fluid. Thus we can say that both the lower and the higher tones are taken up by the conducting apparatus, but *whereas for the perception of the lower tones the whole apparatus is necessary, for the perception of the higher tones it is quite enough if the two windows are working.*

II. For the perception of bone conduction there are commonly two ways accepted: (1) the pure bone conduction (Rein ossale Leitung) and (2) the craniotympanale or osteostapediale route.

In the first supposed case the sound waves are carried directly to the labyrinth through the bones of the skull; in the second case this is done with the aid of a drum or footplate.

There are many objections to the hypothesis of the pure bone conduction. Bezold thinks it absurd to suppose that the sound waves could, in whatever way they reach the labyrinth through the bones, act there as stimuli. He showed with experiments that the sound waves, under certain circumstances, can penetrate the labyrinth without being perceived.

Bezold's weightiest argument against this pure bone conduction is the fact that under normal circumstances the air conduction is always better than the bone conduction.

This is really quite unintelligible if we accept the theory of the direct route of pure bone conduction, for in this case the bone conduction ought to be always stronger.

In cases of air conduction the sound waves lose much of their energy in the air; in bone conduction they reach the labyrinth in the shortest way through elastic bodies, and therefore the loss of energy is very small.

In the air the intensity of the tones diminishes in proportion to the square of the distance; in solid bodies this is not the case. In the air the velocity of the sound waves is only 340 meters; in solid bodies some thousand meters. (E. g., in lead, 4257 m.; in steel, 14960m.)

Lucae, on the basis of his experiments, rejects also the supposition of the direct route and is of opinion that in the case of bone

conduction the conducting apparatus plays a greater role than the bones of the skull.

I think that these arguments justify us in *rejecting the supposition of the pure bone conduction;* that is, in rejecting the possibility of perception without some sort of functioning of the conducting apparatus.

Let us now investigate the second way of bone conduction, that is, the craniotympanale or osteostapediale route. It means that the drum (craniotympanale) or the footplate ("osteostapediale" Bezold) receives impulses from the vibrations of the bones of the skull. These vibrations of the membranes are supposed to occasion the perception in the same manner as in the case of air conduction.

It is true that all the membranes of the ear, the drum, the footplate ring, and the second drum, receive vibrations from the framework, but it is questionable if these vibrations are strong enough to induce the vibration in the labyrinth fluid.

Experimentally I showed in the above-mentioned study, which I am now reporting, that a distended membrane is only slightly affected by the vibrations of the frame to which it is attached. Moreover, if we take into consideration the other factors producing diminution of vibrations in the conducting apparatus, that is to say, the interferences between the vibrations of the two windows and between those of the ossicles, it appears that this craniotympanale or osteostapediale way is so feeble that it cannot be regarded as the way of bone conduction.

We have another, very weighty argument against this craniotympanale way in the pathological fact, that without the drum and without the function of the footplate the bone conduction can be very good. That is the case in some forms of otosclerosis and we can, in cases of "radical" mastoid operations, eliminate experimentally the functioning of the footplate.

These considerations lead me to suppose that for the bone conduction only one part of the sound conducting apparatus is necessary, that is, the second drum.

So we must reject also the second commonly accepted way of the bone conduction, that is the craniotympanale and osteostapediale route.

Mach says in his treatise on the physiology of the ear, that for the examination of the physical laws of hearing we need physical instruments. I remembered these words when I intended to in-

vestigate the physical details of the bone conduction. So with my father's kind assistance, I constructed an apparatus in his mechanical-technological laboratory at the Budapest University of Technical Sciences.

The apparatus consists of a little ivory tube 65 mm. in length, 40 mm. in diameter and 7 mm. thick. On each end of the tube is distended a very thin rubber membrane. On the upper curved surface of the tube there is a little opening (which can be heremetically closed) through which the tube can be filled with water, from which the air has been expelled by boiling.

The tube must be firmly fixed in a horizontal position and then the vibrating tuning fork must be put on the upper surface. A very sensitive index shows the vibrations of the rubber membranes.

Omitting the description of the several repeated and controlled experiments, it was proved, that the molecular vibrations of the bony tube induces wave-like motions in the fluid towards the elestic membranes.

On this analogy I suppose *that the vibrations of the skull induces in the labyrinth fluid wave-like motions towards the two windows.* One of these wave-like motions directed towards the round window (second drum) is the same as that induced by the footplate in the case of air conduction. The other wave-like motion directed towards the oval window has just the opposite direction and acts as a hindrance to the first one.

To sum up in a few words the conclusions of my study, I can say:

1. The end organ of the cochlea has only one stimulus, and that is the wave-like motion induced in the labyrinth fluid.

2. In case of air conduction the perception of the lower and higher tones happens alike with the help of the conducting apparatus. The difference is only that for the former the transforming action of the drum and ossicles is necessary, whereas for the higher tones it is quite enough if the two windows function normally.

3. In case of bone conduction there must also arise the same wave-like perilymph motion as is produced in the case of air conduction because it is the only stimulus for the auditory nerve. This motion directed towards the round window arises in the labyrinthal fluid through the molecular vibration of the skull bones, but at the same time there is produced another motion directed towards the oval window. As only the first of these motions is necessary for

perception, in case of bone conduction only the functioning of the round window is required.

4. If neither of the windows is elastic no wave-like motion can arise in the fluid; there is neither stimulus nor perception.

Having simplified in this way the different physiological opinions, let us now investigate the local diagnostical value of the tuning-fork tests. Without entering into the well-known details of its methods I will try to explain the following points: (1) The shortening of the higher or of the lower tones in the case of air conduction. (2) The shortening of the bone conduction (Schwabach's test). (3) Why the air conduction is normally better than the bone conduction (Rinne +), and what is signified by the reverse of this relation (Rinne —). (4) The lateralization of the bone conduction.

I. THE SHORTENING OF THE HIGHER OR OF THE LOWER TONES IN CASES OF AIR CONDUCTION.

As in the case of air conduction every tone perception occurs with the help of the conducting apparatus and naturally through the cochlear nerve, the shortening or loss of the higher or of the lower tones may be occasioned as well by the disease of the conducting apparatus as by the disease of the nerve. Therefore the shortening of the higher tones alone, taken as one symptom, or the shortening of the lower tones alone, does not give us any sound basis for the local diagnosis, but the comparison of these two data guides us to some local diagnostical conclusions.

We must regard the above-mentioned differences, viz., that for the perception of the lower tones the function of the whole conducting apparatus is necessary, but for the higher tones only that of the two windows. In testing the higher and lower tones perception we must also take into consideration the well-known pathological fact that the diseases of the nerve begin always in the basal part of the cochlear and appears clinically in the shortening of the higher tones.

Here, as in all diagnostic examinations, we must consider the symptoms in their entirety; we must take all the tuning-fork tests together to determine the local diagnosis.

As to the function of the two windows, I am of opinion that we must make some distinctions.

Although the opening of the oval window is larger than the round window, we must not forget that in the middle of this opening is the bony footplate and the only elastic part of that is the

ring band (ligamentum annulare), whilst the whole opening of the round window is covered with elastic membrane (the second drum). Consequently the oval window can lose its elasticity easier than the larger second drum. Let us regard separately the circumstances and consequences of the rigidity of these two windows:

I. The oval window's rigidity can occur in two ways:

(a) When the mobility of the drum and the ossicles is diminished, as is the case in the middle-ear diseases especially in the so-called post catarrhal adhesions.

(b) When the ring band itself gets rigid as it is to be found in many cases of pure otosclerosis. The functional consequences of these two cases are quite different.

In the first case, as the drum and the ossicles are less mobile, that is to say the microphone apparatus is diseased, the transformation of the lower tones will be wrong, and therefore the hearing of them impaired, whereas, the perception of the higher tones remains good, because they are preceived, directly through the elastic part of the oval window, which is, in this case. all right. The bone conduction is lengthened in this case.

In the second case, when the elastic ligamentum is itself diseased, it can only with difficulty perceive the short and frequent vibrations of the higher tones, and so the hearing of them is shortened. If the transforming apparatus is functioning well, the strengthened vibrations of the lower tones are in a certain degree able to move the rigid ligamentum and therefore the hearing of the lower tones is relatively better than that of the higher tones. The round window is functioning well, therefore, the bone conduction is normal. In the mixed cases of these two diseases, which always appear when the otosclerosis is combined with some post catarrhal deformities, the higher and lower tones are both impaired, but the bone conduction is normal.

II. *The diseases of the round window* is a neglected chapter of otology. Prof. R. Panse twenty-two years ago wrote a classical monograph about the deafness caused by the rigidity of the windows, and there are some very important pathological data which are not yet included in the clinical part of our study. There we can find some classical cases of the diseased round window (in Toynbee's Catalogue, cited by Panse, about fourteen cases). From the clinically tested and also post-mortem examined one hundred seventy-four cases of otosclerosis in ten cases the round window alone was diseased. The most common pathological change of the

round window is the thickening of it (seven times in twenty-six cases), then the bony narrowing of its cells (six times in twenty-six cases). The total loss of elasticity of the round window is a total hindering of any tone perception.

The moderate elasticity of this window is more easily overcome by the strengthened vibrations of the lower tones than by the directly accepted short vibrations of the higher tones, consequently in these cases the perception of the higher tones will be always weaker than that of the lower tones. The bone conduction is also shortened in this case. These two symptoms were hitherto regarded as characteristic of the diseases of the percepting apparatus.

As to the shortening of the higher or of the lower tones in the case of air conduction, the following types are to be found:

A. *The lower tones are normal; the higher tones are shortened.* It means that we have a guarantee for the integrity of the conducting apparatus, including the two windows and therefore we must look for *the disease in the perception apparatus.* We must bear in mind that in these cases the absolute good hearing of the lower tones is required, because if this is but a little impaired, the symptoms may be caused also by the conducting apparatus, viz., through the lessened elasticity of the ring band or of the round window.

B. *The higher tones are normal; the lower tones are shortened.* In this case the well-heard higher tones show us the integrity of the nerve and also to some extent the function of the two windows. As we supposed above that for the perceiving of the higher tones the elasticity of the ring band of the round window is required in this case the disease will be found in the transforming part of the conducting apparatus.

C. The lower tones as well as the higher tones are shortened. In cases where the shortening or loss of both tone classes is equal, theoretically we are not justified in forming any conclusion as to the local diagnosis. I must point out that in such cases it is always necessary to test the hearing by the aid of several tuning-forks, for it can happen that the hearing of C with 64 double vibrations is null, and in the next octave there is but a moderate shortening.

It is rare that the shortening of the higher and of the lower tones is equal.

In the most cases there is a certain proportion in the shortening, so that the cases resemble the above mentioned A or B types.

II. *The shortening of the bone conduction* (*Schwabach's test*).

Schwabach regards the shortening of bone conduction *always* as a local diagnostical symptom for the diseases of the percepting apparatus. As the bone conduction is perceived with the help of the second drum through the cochlear nerve, the shortening of it can be occasioned either by the disease of the round window or by the disease of the percepting apparatus.

Hitherto we accepted the shortening of bone conduction alone as a sign of the diseases of the nerve, although Panse called attention to the fact that the diseases of the round window cause also shortening of the bone conduction. *We are only justified in doing this if we have a guarantee for the integrity of the second drum.*

Consequently we must change our views with regard to some physiological and pathological details.

(a) The physiological shortening of the bone conduction observed in elderly persons, we explained hitherto by the senile involution of the cochlear nerve. It seems more acceptable to suppose that it is occasioned by the rigidity of the elastic membrane of the round window. We can find many analogies for the senile calcification (e. g., the presbyupia), but not for the senile involution of the nerve in the other organs of the senses.

(b) Very often we were compelled on the basis of Schwabach's opinion to suppose the affection of the percepting apparatus in diseases of the middle ear.

Generally we can say that in middle-ear diseases the hearing for lower tones by air conduction is shortened and therefore we must examine carefully the condition of the two windows. As the oval window has a close connection with the ossicles and the drum, and in this way with the diseased part of the middle ear, and as it is entirely exposed to the injury of the swollen mucous membrane, the pathological symptoms of the lessened elasticity of the oval window never fail in the case of middle-ear inflammation. It means that the perception of the lower tones by air conduction is always wrong, and the bone conduction is lengthened. But if these pathological changes extend to the hidden round window, the symptoms of its lessened elasticity will appear, that is the bone conduction will be shortened and the perception of higher tones by air conduction considerably diminished.

In this way we are not justified in supposing *always* a "labyrinthitis" if during the middle-ear inflammation the bone conduction is shortened.

(c) For the same reason we suppose a secondary degeneration of the nerve in *many cases of otosclerosis.* We will not deny the possibility of the inactive degeneration of the nerve, but this occurs very rarely as Panse remarks. Therefore, I am of opinion that in these cases the shortening of the bone conduction is rather the sign that *the ossification of the environs of the oval window is extended to the round window.*

III. *Why the air conduction is normally better than the bone conduction* (*Rinne* +) *and what is signified by the reverse of this relation* (*Rinne* —).

We said above that in case of bone conduction two wave-like motions arise in the labyrinth fluid. The first of these motions is directed towards the round window. As the direction of these motions in the scales is opposite, they weaken each other. This is the cause of the loss of energy. The vibrations of the tuning-fork, which have arrived to the fluid through the bone conduction almost without any loss of energy, here become weaker than the air-conducted vibrations which induce through the footplate only one wave-like motion in the fluid.

There is nothing new in the theory of the loss of energy caused by two interfering motions. Mach speaking of the relation of the air and bone conduction assumes this loss and denotes it by the expressions "Abfluss" and "Zufluss." Kobrak in his latest text-book gives an elegant graphical representation of it and assumes the injurious interference of the craniotympanale conduction on the pure bone conduction as the cause of the loss of energy.

According to my theory, when the second wave-like motion of the fluid diminishes, or is absent—and that is the case when the footplate is less mobile or even rigid—there is no hindrance to the first wave-like motion and all the energy is spent on the single wave-like motion directed towards the round window. That which strengthens the bone conduction weakens the air conduction and so the normal relation is inverted, Rinne negative.

This is the case if we close the meatus externus by the tip of the finger or if it is closed by cerumen, because the air column of the meatus is pressed on the drum and in this way the ossicles, including the footplate, are to a certain degree less mobile. This is the case also whenever the middle ear is diseased, because the pathological changes in the mucous membrane hinder the mobility of the ossicles.

The negative Rinne indicates always the loss of elasticity of the oval window, which may arise from various causes in the external or in the middle ear.

The positive Rinne taken as one symptom can be occasioned as well by the disease of the round window as by the affected nerve. If the shortening of the air and bone conduction occurs proportionately, this is rather a symptom that the percepting apparatus is affected.

IV. *The lateralization of the bone conduction (Weber's experiment).* This experiment investigates the symmetry of the bone conduction. If it is equal in both ears, the tuning-fork, placed on the median line of the skull will be equally well heard on both sides; that is, there is no lateralization of the tone, if of course there is no assymmetry in the skull bones or cavities (e. g., Empyaem of the Highor's antrum). But in every case where the bone conduction is not equal, *a lateralization will take place towards the ear with the better bone conduction.*

As we mentioned above, the bone conduction is always longer *when the footplate is less mobile* and the round window intact, and therefore it is evident that *in these cases the tone of the tuning fork will be lateralized towards the affected ear.*

And whenever the bone conduction of the affected ear is shortened—that is to say the bone conduction of the unaffected ear is comparatively longer, the localization will take place towards the unaffected side.

Evidently, as the shortening of bone conduction can be occasioned not only through the labyrinth affection but also through the diseases of the round window, *the lateralization towards the unaffected ear does not always signify the disease of the percepting apparatus.*

THE TECHNIQUE OF TONSILLECTOMY UNDER LOCAL ANESTHESIA.*

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There are three considerations of importance in removing tonsils under local anesthesia. The most important consideration is the complete removal of the tonsil without mutilation of the surrounding structures; The next consideration is that the operation be rendered as painless as possible; The third consideration is that the tonsils should be removed as quickly as possible.

The operation of tonsillectomy has gone through many stages. In the first place there was the hard fight between the champions of tonsillectomy and those who considered that a tonsillotomy was all that was indicated. During this period the champions of tonsillectomy were so intent upon getting the tonsil all out, that the finer details of technique received little attention. The results in many cases were fearful and wonderful; mutilation of the pillars, complete removal of one or both pillars, amputation of the uvula and on account of lack of attention to details often a portion of the tonsil left imbedded in a mass of cicatrical tissue, with resulting contraction and deformity. As the operation became established on a firm basis and the profession became practically a unit upon the necessity of complete removal, men began to devote attention to the nicer details of technique, until today the operation is a piece of art, removing only the tonsil and leaving the surrounding structures intact and unimpaired.

This result was brought about by those men who advocated adequate exposure of the field, adequate illumination of the field, and painstaking attention to all the details of dissection. These things were set forth by the author in a paper before the American Medical Association in 1912.

The writer has not yet reached the ideal in local anesthesia. Though the great majority of patients complain of absolutely no pain a few complain of varying degrees of pain. Some of these who complain most, give no evidence of suffering, such as flinching, and I am inclined to think that in a large proportion of those who complain the suffering is from the mental dread of the operation.

*Read before the Southern Section of the American Laryngological, Rhinological and Otological Society at New Orleans, April 27, 1920.

This brings up the question as to what cases are suitable for local tonsillectomy. I would say that tonsils which have been the seat of recurrent attacks of peritonsillar abscess are not suitable for operation under local anesthesia. While I have operated on many at the earnest solicitation of the patient, the tonsil usually has to be taken out in a number of pieces which makes it very trying on the patient as well as the surgeon. Then, too, there are patients with reflexes so sensitive that it is almost impossible to resort to any manipulation in the throat. It is much more satisfactory to have these patients under a general anesthetic.

Aside from these two classes of cases I am generally governed by the wishes of the patient. I think it is a mistake to over-persuade a patient. A patient who has a nervous dread of the operation and wishes to take a general anesthetic had better be indulged, as such a patient is liable to break down and create a distressing scene. I think it is a mistake to make an arbitrary ruling as some men do, that all adult patients are operated on under local anesthesia, or that all patients are operated on under general anesthesia.

Our decision in each case should be the result of reasonable regard for all the conditions present.

One of the drawbacks to operation is the profuse flow of saliva which sets up in most cases. Flowing down the throat it causes the patient to choke and cough and interrupts the operation. To combat this I give one one-hundredth of atrophin sulphat hypodermatically. If the patient is nervous one-eighth or one-quarter of morphia is added to it.

The preliminary swabbing of the throat is done with an eight per cent solution of cocaine. This is mopped on the throat for three applications at intervals of five minutes, special attention being paid the pharynx, as that is the area that causes the most retching and gagging. Fifteen centimeters of a one-half per cent solution of apothesin to which six drops of adrenalin solution (1-1000) has been added, are injected around the tonsils. The points of injection are usually six, one on each side of the base, one on the anterior and one on the posterior pillar, and two in the supratonsillar region. An effort is made to inject the capsule as well as possible. For this purpose Canter's screw is used to draw the tonsil from its bed so as to get at the capsule. When the injection is finished the tonsil is surrounded by a ring of infiltration. I think the elevation of the

mucous membrane by the infiltration helps the dissection. Seven to ten minutes are allowed to elapse between the injection and the operation.

The three considerations I had in mind in writing this paper are in the order of their importance, thoroughness, painlessness, and speed.

The first two we have considered. The necessity for getting the operation over with as quickly as possible must be apparent I think to everyone. The patient is on a nervous strain and has keyed himself up to endure the ordeal and the more it is prolonged, the more likely he is to break down or else carry away an unpleasant impression of the operation and the operator's skill.

Tonsillectomy is really two operations. As generally practiced one tonsil is removed and time allowed to elapse for the bleeding to check and then the other tonsil is operated on. This is very trying to certain types of patients. They have their courage screwed to the sticking point for the first tonsil and they go through with satisfactorily but when faced with the second their courage fails and it is only by coaxing and urging that they can be induced to go on with the second. Indeed I have seen patients, not in my own practice, but in clinics resolutely refuse to have the second tonsil removed, and walk out without having the operation completed. It was these considerations which led me to devise a technique which would make it possible to remove both tonsils practically at the same time, so that as far as the patient is concerned it would seem to be a single operation. Another point in favor of such a technique is that sometimes most unexpectedly the removal of the first tonsil is followed by a profuse hemorrhage which takes time to get under control and when it is finally controlled the patient is usually frightened and his morale badly shaken so that the removal of the second tonsil becomes a real ordeal both to the patient and the surgeon.

The technique as I practice it requires two tonsil forceps which can be locked on the tonsil, and two snares. The forceps are of the type which allow the snare wire to slip over the handles without removal. The snares are of the powerful pistol grip type devised by Brown. A powerful snare is essential. For some years I employed a thumb and finger type and on numerous occasions encountered tonsils which were removed with the greatest difficulty

after numerous attempts. I have had snares to bend in my hands Such experiences are very trying to the patient and distressing tc the surgeon. What is needed is a powerful instrument that will not bend and that will remove the tonsil with one swift pressure The Brown snare fulfills the requirements and is strongly and simply made with nothing about it to get out of order. The snare is threaded with number 9 piano wire, I think it is important to have a strong stiff wire that does not easily get out of shape.

When ready to proceed with the operation the patient is told that we wish to examine the tonsil to see if it is ready. We then proceed to apply the forceps. The type of forceps used is of the utmost importance. What is needed is a forcep with a powerful grasp that will not tear out of the tonsil when traction is made. It must admit of the snare loop slipping over the handle without removal, the teeth must be narrow enough to slip between the pillars without engaging them and it must have as little bulk as possible so as not to interfere with the working space in the throat. The forceps devised by the writer fulfill these requirements. When the patient is told that we wish to examine the tonsils to see if they are ready he will readily allow the forceps to be locked on the tonsils without fear as he thinks the operation has not yet begun. One blade of the forceps is placed deep in the supratonsillar fossa and the other is inserted into the base and the forceps locked firmly in the tonsil. The tonsil is lifted from its bed and its contour and attachment noted. The other pair of forceps is then locked on the other tonsil in the same way. The assistant having the two snares in easy reach, hands the surgeon the knife, and with a few quick strokes the left tonsil is freed from its attachments, especial care being used to free the supratonsillar region, as it is essential that the snare should get well back of the superior pole. The left tonsil being freed, the right tonsil is quickly freed in like manner. The assistant now hands the surgeon a snare and at one stroke he removes the right tonsil. While the surgeon is removing the right tonsil the assistant slips the loop of the other snare over the forceps attached to the left tonsil, and takes the snare and the forceps to which the right tonsil is attached out of the surgeon's hand and with a quick stroke the surgeon removes the left tonsil and the operation is over. The operation is over so quickly that practically all patients think that they have had only one tonsil removed and are invariably surprised when told that both tonsils are out.

In an uncomplicated case the time consumed is from fifty to sixty seconds. The shortest time was thirty-five seconds.

After the tonsils are removed the bleeding is carefully checked and the patient is not allowed to leave the chair until the throat is absolutely dry. This rule which I have always followed under a general anesthetic, is even more necessary under a local anesthetic. On account of the use of adrenalin the bleeding is much less at the time of removal under a local anesthetic than under a general, but for that very reason the tendency to delayed bleeding is much greater when the constricting effect of the adrenalin has passed off. On account of the bleeding being slight we are tempted to trust it to stop, but that is a mistake. No single procedure has given me greater satisfaction than the rigid adherence to the rule that a patient shall have a dry throat before leaving the operating room.

Immediately after removing the tonsils cotton sponges on sponge holders, wet in sterile water, from which the excess moisture has been squeezed are thrust into the fossa and held for five minutes. This will usually control bleeding that can be controlled by pressure. If there are still bleeding points after removal of the sponges they are caught with artery forceps where possible and the forceps allowed to stay on several minutes. If the forceps do not control the bleeding then a small Michel skin clip is clamped on the bleeding point. This holds it absolutely secure and one can feel sure that the bleeding will not recur. They usually slough off in a few days but sometimes it is necessary to remove them. I think these little clips are our surest reliance in hemorrhage that is controlled with difficulty. Their application is so simple and presents none of the mechanical difficulties of ligation.

In the case of delayed bleeding, which I understand to be bleeding that comes on within the first twenty-four hours, what are the measures for control that we have at our command?

In the first place I would like to say that it is my opinion that most cases of delayed bleeding are cases that have never stopped bleeding. Seeing that every patient has a dry throat before leaving the operating room will eliminate these cases. There are, however, undoubtedly cases which have a tendency to bleed. Not true hemophiliacs but patients with a delayed coagulation time and if questioned they will recall that they bleed freely from slight injuries and that the bleeding persists for sometime. I have had several

of these cases whom I have sent away from the table with absolutely dry throats in whom bleeding recurred after several hours. When called to a case of this kind we discover as a rule that the bleeding is confined to one side and that the fossa is filled with a clot. The first thing to do is to clean the clot from the fossa thoroughly and look for the bleeding point. If it can be seen it is grasped with the artery forceps. If the forcep's pressure does not control then the Michel skin clip is applied. But often times the bleeding point is low down and hard to locate on account of its position, the sensitiveness of the throat, and the flow of blood itself. In that case the author's tonsil clamp is applied. The gauze pad is soaked in thrombo-plastin and the clamp is left in position for an hour, which usually controls the bleeding absolutely, but if not, it can be reapplied for another hour. I have only had two cases in which other measures had to be resorted to after applying the clamp.

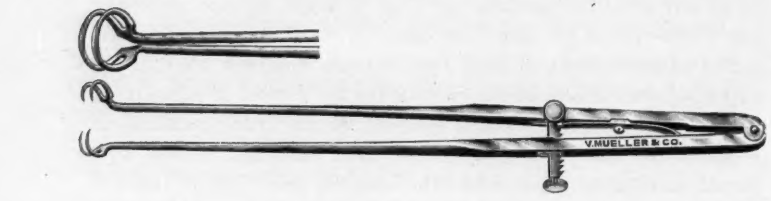
We look upon cases of high blood pressure with dread, but in no more than five cases have I had after-bleeding. In the great majority of cases it has seemed to me that the bleeding was actually less than usual. In the case of a man seventy years old with a blood pressure of 235 the bleeding was no more than a trace. As a precautionary measure I omit the adrenalin solution from the anesthetic in cases of high blood pressure. The point of age having been brought up I want to record that the oldest patient upon whom I have performed a tonsillectomy was a gentleman in his seventy-eighth year. I may add that no patient I ever had stood the operation better or had less trouble afterward. I have operated upon many patients over sixty and a number over seventy and my experience leads me to believe that there is practically no age which may not be given the benefit of tonsillectomy, where it is indicated. None of the things we have been taught to fear in the aged has materialized. The hemorrhage has not seemed so great as in young or middle aged adults, the shock has been no greater and the healing and convalescence has proceeded just as rapidly and the benefits following the operation have been just as apparent. I have eliminated mere age as a contra-indication to operation.

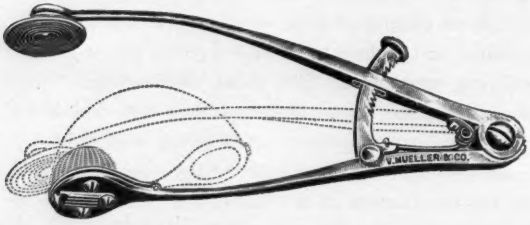
I have digressed somewhat but I would like to sum up the conclusions of my experience with regard to hemorrhage. My opinion

is that hemorrhage is dangerous and that from the time we realize that bleeding is going on we must be unremitting in our efforts until the bleeding is stopped. I have never had a patient to show the effect of tonsillar hemorrhage by pallor or any of the objective signs of loss of blood, but I am perfectly sure it is because I never let up in my efforts until the bleeding is controlled. I have not ligated a vessel in five years, I have never sutured the pillars, and I have never placed an adult under a general anesthetic for the purpose of controlling hemorrhage. It might be my fate to do so at any time, as one can see that it might become necessary, but I believe that in nearly all cases we have measures that will suffice without resort to these two extreme measures. We are so rich now in the means at our disposal for the control of hemorrhage that I cannot think without a shudder, of the crude measures in vogue when I entered surgery, twenty-four years ago. Those were the days of *laisses faire* when the surgeon said "Let it alone, it will stop itself," but when it didn't stop and the patient had bled to the point of exsanguination, everybody including the surgeon was in a panic, and if the patient recovered it was with the memory of a terrifying experience. The point of bleeding: There seems to be no point in the fossa where we may not find bleeding, but in the great majority of cases of bleeding which have required active measures to control the hemorrhage, the bleeding has been from the tonsillar branch of the facial artery. I think the reason that men attribute the bleeding to other vessels is the fact that the tonsillar artery varies greatly in the point where it pierces the capsule. It may pierce the capsule at any point from the base of the tonsil to the supratonsillar fossa and sometimes it does not pierce the capsule at all, for occasionally after the removal of the tonsil the large vessel can be seen lying exposed but uninjured, traversing the fossa from bottom to top. Thus we see that this large vessel may be injured anywhere in its course from the region of the lower pole to the supratonsillar fossa. The spurting from this vessel is nearly always up as it generally pierces the tonsil about the junction of the lower and middle third. Several times I have had this artery to spurt out of the patient's mouth and strike the anesthetist or other persons standing around the patient's head. Sometimes this vessel is very large, on one occasion when I removed the left tonsil from a patient she leaned over a fountain cuspidor and to my surprise she almost instantly filled the bowl

with blood. As quickly as possible I put her head back and caught the vessel with artery forceps. I allowed the forceps to remain for half an hour. When I removed it the bleeding was as profuse as ever and I replaced it and allowed it to stay for an hour. When I removed it the bleeding recurred with undiminished force, I then placed two Michel skin clips on the vessel, one above and one below the forceps which effectually controlled it.

I wish to say a word about true secondary bleeding. My cases of secondary bleeding have all come on the fifth day. In twenty-





four years I have had six cases of secondary bleeding from the tonsils and three cases from the adenoids. I have noticed a characteristic about this type of bleeding which I have not seen recorded. I wonder if the experience of other men coincides with mine in this respect? The characteristic I have noticed is that after the hemorrhage is checked it has a tendency to recur at intervals for about thirty-six hours. This could not be observed in the cases of bleeding from the adenoids as I packed them postnasally and allowed the packing to remain thirty-six hours. This type of bleeding in my cases has not been alarming except in

the case of the adenoids, all three of which cases bled profusely. Secondary bleeding is undoubtedly connected with the separation of the slough. Infection takes place beneath the slough in all probability as I have noticed an odor in these cases.

The most profuse bleeding I have had has been in cases of frail thin women. The point of most persistent bleeding has been from a small vessel which emerges from the posterior pillar at about the junction of the upper and middle third. It is most important to see that the bleeding from this apparently insignificant vessel is effectually checked, because it may go on unnoticed for hours. Our first intimation is when the patient throws up an enormous quantity of blood. Concealed hemorrhage is the "bete noir" of the general surgeon and we must learn our lesson from him. He closes no cavity until hemorrhage is absolutely checked and our problem is precisely analogous.

In making this contribution to the already voluminous literature of the tonsil, I am only paying tribute to the importance of the subject, and in closing this paper I wish to make a plea for the more serious consideration of the operation of tonsillectomy. Dr. H. W. Loeb has shown how a throat after an apparently clean operation can harbor a piece of tonsil responsible for the gravest type of constitutional infection. I have had several cases of this type where an inspection of the throat gave the impression that a clean tonsillectomy had been done. A careful search disclosed a small crater like opening and underneath was found a piece of tonsil harboring a pocket of pus. Where such grave consequences can ensue upon the leaving behind of a small piece of diseased tissue it behooves us to use the utmost care in making our operations absolutely clean.

We cannot estimate the harm that results from looking upon the operation lightly and of small importance and going through it hurriedly and carelessly.

Let us do a clean thorough workmanlike job, granting to the operation the dignity and the importance that it deserves.

210-214 Hitchcock Bldg.

A CASE OF MULTIPLE BONE FORMATION IN THE TONSILS.

DR. J. E. CALHOUN, Dubuque, Iowa.

Cases of cartilage and bone formation in the tonsils have been described, but the condition is rather infrequent. Cartilaginous or bony deposits may be almost microscopic or they may be large enough to be recognized with the naked eye. They are supposedly due to vestigial remnants of the second bronchial cleft, or to a metaplasia occurring in fibrous tissue such as is sometimes found in other glandular organs, as for instance the parotic or mammary gland, and the testes. These cases differ from those that have been reported as due to elongated styloid process in the tonsils of which in recent years a few have been reported in the literature.

The following case is one of bilateral multiple bone formation in the tonsils. S. W., a well-developed man of 40 years of age, had trouble with his tonsils two years previously. Since then he has had several attacks of sore throat, the last attack having occurred ten months ago. The patient's general health has been good. He gave no history of rheumatism or any previous operation on his throat.

Using a Beck-Mueller tonsillectome the tonsils were removed under local anesthesia. There was the sensation of cutting through very tough tissue.

Examination of both tonsils showed the capsule unusually thick and tough and both tonsils contained in their substance numerous hard bodies. On opening the tonsils these bodies were found to be separate, smooth and white, of varying sizes. They looked like bone and felt and cut like bone. Microscopic examination by Dr. Cora Hesselberg showed them to be bone and this diagnosis was further corroborated by Dr. Ralph L. Thompson, of St. Louis University Medical School, who also reported bone formation from specimens submitted to him.

256 Tenth Street.

TONSILLECTOMY IN THE ADULT UNDER LOCAL ANESTHESIA, BY THE SLUDER METHOD.*

DR. RICHMOND MCKINNEY, Memphis.

Ninety-nine per cent of success with any operative technic is, or should be, sufficiently good to satisfy even the most exacting surgeon. This is the ratio of success that I have had with the Sluder method of tonsillectomy in the adult, under local anesthesia. The patients have ranged in age from 17 to 65 years, and have presented every variety of tonsil, from the discrete, hypertrophic form to the so-called "submerged" type, which so often are the source of systemic infection.

Why the 1 per cent of failure? This occurred in the case of a short-necked man, 54 years of age, who had experienced a number of attacks of peritonsillar abscess, and regular winter visitations of tonsillitis, and in whom the tonsils, which were of the elongated, flat type, were so firmly embedded in connective tissue that I was unable to strip one of them through the ring of either of the guillotines that I had with me. Even in this case I believe I should be successful, if I could have another try at him, which, most likely, I shall not.

Technic. This is noteworthy through its sheer simplicity. A preliminary hypodermic of one-sixth to one-fourth grain of morphin, plain, is given. The patient sits in a chair, or in some instances, reclines in semi-recumbent posture on a table. The pharynx, hypopharynx, tonsils and pillars are swabbed with ten per cent cocain, which is repeated two or three times, at intervals. Particular attention is given to abolishing the hypo-pharyngeal reflex. Novocain or procain, in one per cent solution, with two or three minims of standard adrenalin solution to the dram, are then injected into the upper and lower poles of the tonsils, through the anterior pillar. I use but a few minims for an injection, and do not find it necessary to infiltrate the tissues with any large amount of the solution in order to obtain complete anesthesia. Indeed a one-half per cent solution was used by me at first with eminent satisfaction, and I have found no difference in the degree of anesthesia between the one-half and one per cent solution. Distribution

*Read at a meeting of the Middle Section of the American Laryngological, Rhinological and Otological Society, Cincinnati, Ohio, February 21, 1920.

of the anesthetic is promoted by massaging the tissues with a stout applicator, cotton wound, and dipped in ten per cent cocain solution. Before operating I usually wait about five minutes, since there is no occasion for haste, and we are surer of complete anesthesia.

No dissection or releasing of the pillars is necessary. A nurse steadies the patient's head, with a towel over the eyes, the tongue is depressed, with the depressor in the operator's right hand if the left tonsil is taken first, as I always do, the guillotine is applied at the lower pole, the depressor laid aside, the tonsil stripped into the ring in the customary manner, the blade driven home, and—I always use a Sauer-Sluder—the set-screw run down with the right forefinger, and then tightened until the tonsil is squeezed from its bed. The procedure is reversed for the other tonsil.

My experience has been that the tonsil comes away in a clean manner. It rarely ever is necessary to go back for a remnant, and even when it is, it is very easy to pick this piece up and remove it with the guillotine. In none of my cases have I observed any laceration of the anterior pillar, and I have been gratified with the smoothness of the surrounding tissues, and absence of cicatricial tissue in these cases on post-operative observation.

Pain. Of this, the dread of which causes many patients to refuse tonsillectomy under a local anesthetic, there is practically none. In two or three instances, where I have failed to demand a fresh solution of novocain, I have had complaint of some pain, but the patient afterward has admitted that it was trifling. However, if the solution is fresh, injected without leakage, and a few minutes allowed to elapse after the last injection, the operation is painless.

Hemorrhage. Through hearsay, but I am confident in saying of this assemblage of honest and experienced men, not through personal experience, we are all acquainted with the term "bloodless tonsillectomy." God knows I wish this were not a euphemism, but I am convinced that the only "bloodless tonsillectomy," in a true sense, would be one performed upon a cadaver.

In not one of the cases in which I have used the method under discussion have I had a primary hemorrhage—in fact, the bleeding at the time of operation has been so slight as oftentimes to excite comment, even from the patients. I suppose this is what some of our hopeful colleagues would call "bloodless tonsillectomy." But I have had some secondary hemorrhages, coming on from two to seven days after operation. Whether I have had a larger per-

centage of this disagreeable complication with my present technic than formerly, I am unable to say. Several years ago I reported from eight hundred to one thousand cases, all done under ether, and by the dissection and snare method, with but four cases of hemorrhage in this number, and these patients were of all kinds and conditions, clinic and private.* However, comparatively few of these were adults. We have all been doing proportionately more adults in these recent days of focal infection.

Secondary hemorrhage after tonsillectomy is generally regarded as due to sepsis, which causes a slough, and opens the vessels. I have never had a secondary hemorrhage except in adults, and as I have had this in ether cases as well as in those in whom a local anesthetic was used, I am not prepared to argue that one method is freer from this complication than another. Tonsillectomy in adults is usually done for the removal of suspected foci of infection, and we do not as a rule advise the operation in the adult unless we are convinced that the tonsils are diseased. By a diseased tonsil we mean one that is subject to inflammatory attacks, or one that secretes a deleterious material, which is probably being absorbed into the system, as shown by enlarged neighboring lymphatics, and remote effects, such an endocarditis, nephritis, acute and chronic, arthritis, etc., and therefore we are operating in a locality where a low-grade type of infection already exists, and invites sepsis. How to avoid this is something that I have not as yet learned in my experience with tonsillectomy.

Taking a recent series of fifty cases, all in private practice, and all operated upon by the Sluder method, the youngest of these patients being 17, and the oldest 65 years of age, secondary hemorrhage occurred in four cases. The ages of the patients were 18, 19, (2), and 32, and came on two, four, five and seven days after operation. Two of these were comparatively severe, and both of these latter were in patients in whom tonsillectomy was done for a kidney complication.

The worst case was in a woman aged 32, who had a pyonephrosis. Her tonsils were not large, but she was subject to attacks of tonsillitis, and the crypts were full of cheesy material. The submaxillary glands on both sides were enlarged. Pus had been present in large quantities in her urine for some time. Tonsillectomy in the manner described was done, the fossae being left absolutely

*McKinney, Richmond: Tonsillectomy and Tonsillar Hemorrhage, Journal of the Tennessee State Medical Ass'n, November, 1913.

clean. There was no bleeding of any moment whatsoever at the time of operation. Four days afterward she began bleeding from the right fossa. This was in the form of a slow ooze. The woman was so solicitous that she be not returned to the hospital, to be put under ether and the pillars sutured in order to stop this bleeding, that I consented to delay. After a short while the bleeding ceased, but began again early the next morning. Her general condition being good, I waited for the bleeding to stop of itself, which it did shortly afterward. She bled again the next day, but not so profusely, and from that time experienced no further trouble. The diseased kidney ultimately was removed, and was found to be in very bad condition, riddled with pus.

The other case which may be characterized as having been severe, was in a young man of 19, who had an acute nephritis. He had been bothered a good deal with attacks of tonsillitis all his life, and some two or three weeks before, while attending the University of Tennessee, at Knoxville, had a peritonsillar abscess on one side.

Tonsilectomy was done, this being clean and free from bleeding. Early in the morning of the fifth day he began bleeding from the left fossa. This stopped after a short period, but the following night, about 1 o'clock, I was phoned from his home, in a town twenty-five miles from Memphis, that he was bleeding badly, and that his brother, a Memphis physician, who was with him, desired me to come out at once. Arriving there an hour later, I found that there was a steady ooze from the left fossa, and as usually is true in these cases, he had vomited several times, the stomach contents having been increased by several glasses of water, so that conditions naturally looked rather alarming. The bleeding continuing, we sutured the pillars, using only a local anesthetic, having an unusually intelligent and courageous patient with whom to deal. The wound still showing some oozing after the sutures were tied. a self-retaining clamp, holding a pad of gauze against the pillars, was placed in position. This pressure, however, finally broke the sutures, so the pillars were then mattress-stitched together, and there was no further bleeding, recovery being uninterrupted. The circulation in this case was always good, the pulse strong, and never over 110, and most of the time below 100. The bleeding probably would have stopped of itself, without damage to the patient, as it usually does, but being a doctor's brother, we probably had "too much doctor."

The case that occurred seven days after operation began in the early morning of the eighth day—why do they always occur at night, when we are hitting it up on high for our seven or eight hours of good and needed sleep?—and when I saw him, about 5 o'clock, he had been bleeding for an hour or more, profusely. Examination showed an ooze from the right fossa, but this stopped while I was preparing to apply a clamp, and there was no subsequent bleeding.

As a matter of information, I should like to inquire if anyone of my auditors has known, or even authentically heard, of a case of fatal secondary hemorrhage following tonsillectomy? My observation has been that these hemorrhages are due to a localized sepsis, probably starting beneath a blood clot, and that there is a superficial sloughing, causing a venous bleeding, for I have never seen arterial bleeding in any of these cases, and would this bleeding not stop automatically in practically all of these cases after a short while?

My plan usually is to elevate the head, give a hypodermic of morphin, crushed ice by the mouth, and then "watchful waiting." Still it frequently is very trying to the patient and the family when apparently nothing is being done to arrest the hemorrhage, yet I am inclined to believe that a let-alone policy in most of these cases is the best.

But this was not intended as a discussion of the treatment of post-operative tonsillar hemorrhage, my object being to call attention to a technic for tonsillectomy in the adult that is simple, rapid and efficient.

Bank of Commerce Building.

GERM LIFE—THE MASTOID BONE AS A LIVING MEDIUM.

Dr. Alfred Kahn, New York.

May I ask you to recall your days back at the medical school, when you were studying bacteriology—you will remember aside from studying the characterization of bacterial life under the microscope and the characteristics one germ bore to another or the distinguishing features that one germ bore to another, the professor pointed out to you that each germ cultivated—in colonies or in certain media—had its special individuality. So that, for example, let us say a stab culture of diphtheria bacillus presented different characteristics of growth as compared in differentiation to other organisms, the streptococcus auris—if you will. In other words, to a person familiar with the cultural growth of germ life in pure colonies, it is comparatively simple—by a comparison of the colony growth in culture—to distinguish one colony from other germs growing in like manner, in the same media.

I feel, after careful observation, that the same conditions of differentiation can be distinguished clinically in a diseased mastoid, and that the destruction taking place therein can be differentiated almost as easily clinically as in the laboratory. The infections that we are chiefly apt to contend with clinically in a mastoid are the pneumococcus, the streptococcus family, hemoliticus mucosus and capsulatus. If one is able to distinguish the clinical markings of these various germs, he is often in a position to so manage the operation as not only to lessen the chance of complications, but actually save the patient's life. In reality, to my mind, it ought to be a part of the technique, that as soon as the mastoid is opened, a smear should be sent promptly to the laboratory and the surgeon should have a report back from the laboratory in from five to fifteen minutes, so that he would be in a position to know with what germ he was dealing. This, of course, to confirm his clinical observations. If this were done, the great majority of mastoid operators would soon become so familiar with the growth of these various germs in the mastoid, that eventually they would be so sure of themselves that they would be in a position to tell without laboratory examination, just what germ was attacking the bone under observation. In this connection, it might be well to point out that though a culture may have been made before the operation, from pus in the external auditory meatus, it would not necessarily be true

—a certain germ being found in the external auditory meatus, that the same germ was attacking the mastoid bone.

To my mind, it has always seemed that the pneumococcus chaws up the bone and presents the disease in a localized mascerated bunch—as if the bone cells were chewed up—so to speak. While the destruction may be great, the diseased area is usually quite firmly localized, and comparatively speaking, danger from complications where we are dealing with the pneumococcus is not nearly so great—and the surgeon can proceed with his operation without undue anxiety. Of course, it will be argued that all mastoids in a state of disease should be absolutely cleaned up, that every crevice of disease should be curetted. And this is as it should be. But there is quite a difference in the state of mind when we know that with the pneumococcus, for example, while there is danger of complications and while the prognosis may be bad, that where the streptococcus is concerned, the danger of complications and death is perhaps in the proportion of 10 to 1. The streptococcus is a very much more dangerous germ, and when in the course of a mastoid operation, you are dealing with a streptococcus involvement, the danger is strongly pointed out—like a red flag at a signal station. And while it will be argued that all mastoids, regardless of what the germ may be—should be thoroughly curetted—still I contend that when a danger is strongly impressed upon the mind of the surgeon, he is apt to be extra cautious—though he would otherwise have been only careful, if you will.

The streptococcus mucosus and hemoliticus, to my mind, have different characteristics clinically and different markings clinically, that distinguish them from the streptococcus capsulatus and from the pneumococcus. The streptococcus mucosus and hemoliticus, to my mind, have a habit of first infecting and mascerating a certain foci and then, as you proceed with your operation, you are apt to find different points of foci scattered through the bone—areas in between seeming only to be slightly involved. I might call it an "apple specking," if you will. These cases usually present a history of long involvement—they might almost be called latent mastoids. A man, for example, will first have a discharging ear, from an otitis media, and then apparently get well, only later to be brought to the hospital, with a latent mastoiditis, presenting almost veiled symptoms. Or he may complain of severe headache and the actual mastoid symptoms are presented only in a shadow. These are dangerous cases—often of very long standing. They are apt

to present complications, and their prognosis must be comparatively guarded. The streptococcus capsulatus—it has seemed to me—does not present this apple specking like the streptococcus mucosus or hemoliticus. You may have one chief area of involvement, where the cells are mascerated, but it spreads in lines from the point of chief foci. It has an especial appetite for spreading out over a wide surface and the involvement is apt to attack the intermediate tissue between the inner and outer tables, close to the surface. Pain elicited on pressure when the capsulatus is the involving germ, is often hard to absolutely determine and localize. There may be spots of slight tenderness at three or four points over the mastoid bone. This is characteristic of the streptococcus capsulatus.

I have never kept any statistics in the matter, but I am rather inclined to believe that most cases of secondary mastoid, all other things being equal, barring out dirty dressings and careless after-care in dressing, after the primary mastoid operation—I am then inclined to believe that most cases of secondary mastoid infections are due to the springing up of an old foci where the first operation was not carried to the finest point. And I believe that the infecting organism is in nine cases out of ten, either the streptococcus mucosus, hemoliticus or the streptococcus capsulatus. To my mind, it is a very great step forward to know at the time of operation, the germ of involvement.

50 East 42nd street.

THE DIAGNOSIS OF BRAIN ABSCESS.*

Dr. Louis Casamajor, New York.

Probably nothing in the field of organic neurology offers such difficulties in diagnosis as do the abscesses of the brain. Brain localization is a difficult problem and requires good co-operation on the part of the patient which is usually not possible in a patient with brain abscess. Likewise the severity of the disease and its usually short course preclude the prolonged examinations necessary for accurate localization. Where diagnosis is at once so difficult and so essential for the life of the patient we have a problem quite unique in the field of organic neurology.

*Read before the Otological Section, New York Academy of Medicine, December, 1919.

The etiology of brain abscesses covers a large scope and, in such a paper, sharp restrictions are necessary. Hence I shall restrict myself to abscesses of otic origin.

Pathological Consideration: The development of localized purulent foci in the brain as a result of purulent ear disease may occur in one of three ways: (1) Direct extension of the infection through the roof of the tympanum or vestibule, through the dura and into the pia. Here the lesion is often of the nature of a localized meningitis with purulent involvement of the cortex (cortical abscess) or immediately under it (sub-cortical abscess). (2) Indirect extension with little or no involvement of the meninges. These abscesses may lie very deep in the brain substance, and here probably the avenue of infection is up the Virchow-Robin lymph spaces in the vessel walls, the only lymph spaces in the central nervous system. (3) Metastatic abscess in the brain may occur from purulent ear disease as a part of a more or less general septicemia. Then the abscess may be formed in any part of the brain, relatively far removed from the diseased ear and even on the opposite side.

The relative frequency in the location of brain abscesses of otic origin may be judged from Heiman's study of 645 cases which are summarized as follows:

Temporo-sphenoidal lobe	64.8%
Cerebellum	29.1%
Cerebellum and temporal lobe	1.7%
Other locations	4.4%
	100.0%

Symptomatology: Here we must further restrict ourselves to the abscesses of the temporo-sphenoidal lobes and the cerebellum, for time does not allow us to consider the diagnosis of brain abscess in general. However, it is in these two locations that 93.9 per cent of all brain abscesses of otic origin are formed.

The symptoms of brain abscess fall into three fairly definite stages of varying duration, any one of which may be so short that it is hardly recognizable as a stage. These stages are: I. The Initial Stage (Stage of Invasion). II. The Latent Stage. III. The Stage of Manifestations.

I. The Initial Stage: This is very varying in duration, and may be entirely lacking. When it is present it is usually marked by indications of cerebral involvement. Fever may or may not be present and when the previously existing ear condition has occa-

sioned fever, this fever shows little or no change. The cerebral signs most usually seen are headache, vomiting and clouding of consciousness. The headache during this stage is usually general, but may be limited to the side of the lesion. Vomiting is more common in cerebellar than in cerebral abscesses. Clouding of consciousness may be of any grade from slight confusion to severe stupor or delirium. Other signs of meningeal irritation may be present. This initial stage usually last from 12 to 20 hours but may extend over a week.

II. The Latent Stage: This is a very varying stage. It may be entirely lacking or it may last a few days, a few weeks or over a year. The symptoms of the initial stage more or less completely disappear, and the patient appears to have recovered from the cerebral irritation. The abscess is now forming as a clearly localized lesion, and as it grows in size, symptoms of the third stage manifest themselves, usually slowly, but sometimes with startling suddenness.

III. The Stage of Manifestations: It is usually in this stage that the neurologist first sees the patient with the puzzling picture of brain abscess. The symptoms now become more clear and divide themselves into two groups: 1. General Symptoms due to the disease and brain pressure from the abscess and surrounding edema and 2. Local Symptoms due to destruction of and pressure on structures in the immediate neighborhood of the abscess.

General Symptoms: Fever is frequently absent in brain abscess and the temperature may be subnormal throughout. At times high temperature may be observed in the evening with chills. When an abscess breaks through into the meninges or the ventricles, continued high fever is the rule. Headache is a constant symptom and while usually localized on the side of the lesion it is not as a rule felt only over the site of the abscess. Generally it is described as a pain over the entire half of the head. Some patients localize the pain rather sharply over the site, but in a number of cases the pain is said to be most severe in a part at a distance from the lesion. Thus in cerebellar abscess the pain may be felt most severely over the forehead. In any event, the position of the headache, even when the skull in this region is tender to percussion, cannot be relied on as a localizing sign.

Vomiting, of the projectile type, is a common symptom, especially in cerebellar abscess. Okada observed this symptom in 75% of cerebellar abscesses and he ascribes it to pressure on the medulla.

Slowing of the pulse rate, even in the presence of moderate fever is a frequent and valuable diagnostic sign; and with this we not infrequently see a similar slowing of the respiratory rate.

The pupils in brain abscess are of no value in diagnosis for they may be normal or show any variation from the normal. Unlike the case of brain tumor we must not insist on the presence of choked disc for the diagnosis of brain abscess. According to Oppenheim and Cassirer it is to be found in only 53% of all abscesses. Okada observed this sign in only 7 of his 96 cerebellar abscesses. This latter author claims optic neuritis without papiledema is much more common. This is explained by the fact that the general symptoms of brain abscess are due much more to brain intoxication than to brain pressure.

Convulsive phenomena, either general, hemi—or local occur with many large abscesses. These may be confused with the convulsions of epilepsy or of eclampsia. The consciousness is always disturbed in varying degrees from slight drowsiness with confusion to absolute coma or delirium. This consciousness clouding always makes diagnosis more difficult for it prevents accurate co-operation on the patient's part, which is so necessary for the proper carrying out of tests on which much of our localization is based.

Local Symptoms: These are most important for it is on these symptoms that we must rely for the basing of our judgment as to the location of the abscess. It is unfortunate that they are so meagre and at times entirely absent. The mental state of the patient is an obstacle sometimes unsurmountable.

Temporo-Sphenoidal Lobe Abscess: This most frequent of all abscesses of otic origin has the least definite of localizing signs. The right temporal lobe in the right handed is one of the "silent areas" of the brain. Abscesses of considerable size may develop here without showing any localizing signs. When the abscess is deep enough to impair the optic radiation fibers, left homonymous hemianopsia results, but the mental condition of the patient may prevent one from discovering it. The left temporal lobe offers more known function to work with, for here is located the "Sensory Speech Area" of Wernicke. In abscesses in this location disturbances in the speech mechanism is the rule. Complete sensory aphasia is practically never seen. The usual difficulty in paraphasia, inability to remember words they wish to use and more or less disturbance in the understanding of speech. This adds another complication to the mental clouding obstructing diagnosis. Pure hear-

ing disturbances of subjective or objective nature are practically never observed.

Cerebellar Abscess: Uusually the localizing symptoms of these abscesses are definite. The patient generally lies in bed with his head turned back or toward the side of the lesion. Often there is considerable rigidity of the neck. When he sits up in bed he complains of increased pain in the head and often dizziness. When erect, he stands on a wide base and in walking is unsteady and asynergic and tends to fall away from the side of the abscess, but may fall the other way. When he raises both hands in the position of taking an oath he is unable to hold them there and both drop suddenly, the one on the side of the lesion oscillating considerably as it falls. Mingazini considers this an important sign. Cerebellar seizures, consisting of attacks of vertigo, nystagmus, very severe headache and weakness have been described but they are by no means constant. When nystagmus occurs usually it is toward the side of the abscess. As the muscular control of the cerebellum is homolateral, cerebellar signs are seen on the same side as the lesion. Besides those already mentioned, changes in the tendon reflexes are the rule, usually a marked dimunition or loss. The Babinski sign is rarely present. All movements of the limb, when the patient is reclining, are asynergic. The patient past points usually toward the diseased side. Unfortunately we cannot always utilize this test in locating the abscess in any particular part of the cerebellum as Bárány had hoped. With the asynergia, adiadokocinesis is usually present.

The diagnosis of brain abscess is a much less accurate matter than one could wish, especially in view of the serious nature of the disease and its serious consequences. The diagnosis must be made early if surgical results are to be excepted. The localization of a small abscess in a large part of the brain is not diagnosis enough for it forces the surgeon to make large openings and probe around. The compilation of carefully recorded clinical observations may some day in the future teach us really to localize brain abscess.

LITERATURE.

HEIMAN: Diagnose des otitischen Hirnabscesses. *Arch. f. Ohrenheilk*, Vol. 73, p. 258.

MINGDZINI: Ascesse E. Tumori Dell' Encephalo. *Riv. di. path. neu.*, Abstract by Osnato, *Arch. of Neu. and Psych.*, Vol. 2, p. 701.

OKADA: Quoted by Lewandowsky. *Handbuch der Neurologie*, Vol. III, p. 208.

OPPENHEIM AND CASSIRER: Hirnabscess, Vienna, 1909.

RUPTURE OF THE TYMPANUM FROM SHELL EXPLOSIONS.*

DR. F. CHAVANNE, Lyons, France.

Ruptures of the tympanum from shell explosions or detonations are frequently complicated by acute purulent otitis media. The size of the rupture, the duration of the wound under unfavorable hygienic conditions of cold and humidity, the existence of concomitant naso-pharyngeal infection, infection from the outside, etc., are the principal factors that bring about this complication. The author reports on 543 personal cases. There were 192 cases of rupture and acute purulent otitis media of the right side; 203 cases of rupture and acute purulent otitis media on the left side: 74 cases involving both sides. In 58 cases there was rupture complicated by acute purulent otitis media on one side and a simple rupture on the other side.

Tympanic ruptures, in these cases, may be quite considerable in extent but usually they are more or less circular or linear. The linear ruptures represented more than one-half of the cases (337 out of the 543). There were eleven cases of punctaform and seven cases with almost complete rupture of the tympanic membrane.

The order of frequency in the localization of the rupture was as follows:

Below and in front, corresponding in situation to the position of seven on the face of a clock, 258 times.

Below and behind, corresponding in situation to the position of five on the face of a clock, 45 times.

Below and in front of the umbo, 35 times.

In front of the umbo, 27 times.

Above the umbo, 26 times.

In front of the malleus handle, 23 times.

Behind the umbo, 20 times.

Behind the malleus handle, 19 times.

Below and corresponding in situation to six on the face of a clock, 18 times.

Below and behind the umbo, 14 times.

In the postero-superior quadrant, 13 times.

The whole extent of the lower half, 11 times.

*Abstract from "L'Oto-Rhino-Laryngologie Internationale," April, 1919.

In the antero-inferior quadrant, corresponding in position to eight on the face of a clock, 8 times.

In the postero-inferior quadrant, corresponding in position to four on the face of a clock, 7 times.

Almost the entire tympanum, 7 times.

In the antero-superior quadrant, 6 times.

In the membrana flaccida, 4 times.

In the whole anterior half, once.

The whole of the posterior half, once.

Almost all of the linear ruptures were vertical in direction or slightly opaque and in only one case was it horizontal.

Tympanic ruptures complicated by acute purulent otitis media often undergo cure without any other complication. Mastoiditis is rare in these cases (the author only encountered eleven in the series).

A certain number of the purulent ear infections become chronic (35 out of 543).

Aside from thirteen patients whose stay in the hospital was prolonged the cure was affected in the following lengths of time:

11 cases in 15 days;

108 cases in one month;

78 cases in a month and a half;

107 cases in two months;

30 cases in two and one-half months;

72 cases in three months;

25 cases in three and one-half months;

47 cases in four months;

22 cases in five months;

16 cases in six months;

10 cases in seven months;

4 cases in eight months.

REPORT OF THE COMMITTEE ON THE ADVANTAGES AND DISADVANTAGES OF THE VARIOUS LOCAL ANESTHETICS IN NOSE AND THROAT WORK.

DR. EMIL MAYER, New York, Chairman; DR. ROSS HALL SKILLERN, Philadelphia; DR. ROBERT SONNENSCHEIN, Chicago, *Committee.*

(Read before the section on Laryngology and Otology of the American Medical Association at its 71st Annual Session at New Orleans, La., April 30th, 1920.)

At the meeting of the Section on Laryngology and Otology of the American Medical Association, held in June, 1919, the following letter was received:

"The Council on Pharmacy and Chemistry, at its recent meeting discussed the deficiency of published data as to the special advantages and disadvantages of the various local anesthetics in nose and throat work. As Chariman of the Committee on Therapeutic Research, I was commissioned to suggest to you that your Section appoint a special Committee to study and report upon this subject. Presumably this Committee would sift the available data and decide what further investigations would be necessary to clarify the subject.

If we are not mistaken in our esimate of the importance of the subject, I feel assured that you will act upon these suggestions. Should your Committee need any assistance, financial or otherwise, our Committee will be ready to co-operate to the extent or its ability.

Very truly yours,

(Signed) TORALD SOLLMANN."

Your Committee was duly appointed. By a strange but happy fortuitous circumstances, we have the honor of presenting this report in New Orleans, the home of Professor Rudolph Matas, who has done more to establish the value of local anesthesia than any other surgeon in the United States, to whom we are glad to pay our respectful homage for his splendid work in this direction, for his scientific attainments, and for the incalculable benefit he has thus given to suffering humanity.

No work of this kind has been undertaken before by any National Society, and your Committee found itself confronted by a most arduous task; the literature alone upon this subject is simply stupendous.

Owing to war conditions many of the local anesthetics were not at hand and hence the investigation was limited to those that were.

Realizing the vast importance of a study of this subject, the following plan was arranged as our objective: To compare local anesthesia in its effects with general.

To note disadvantages following the use of any local anesthetic.

To check laboratory data by clinical data.

To ascertain what clinical evidence the literature affords in support of the use of the several local anesthetics in different conditions and of concentrated solutions rather than dilute in any case.

To determine what cases show idiosyncracy with a view to determine causes.

To ascertain the relative merits of Cocain and the synthetic products.

To determine if hemorrhage during or after operation is greater under local than under general anesthesia.

To study carefully the toxicity, noting especially injuries to the mucous membrane as factors in these latter conditions.

To note the effects of the previous administration of Morphia in reducing dangers of toxicity or in adding to the comfort of the patient.

Finally, to make such recommendations as may be deemed advisable.

This tentative plan received the cordial endorsement of the entire Committee and of the Chairman of the Committee on Therapeutic Research.

To Dr. Sonnenschein was given the task of abstracting the literature, to Dr. Skillern that of assembling the clinical data, and the animal experimentation suggested was kindly undertaken by Professor R. A. Hatcher, of the Cornell University Medical College.

Not a single synthetic preparation that has been thus far presented for our use as a local anesthetic is non-toxic. This does not deter us in its use, but it will surely put us on guard and free us from the belief that any one is absolutely free from danger.

ADVANTAGES OF LOCAL ANESTHESIA.

Until 1914, only monographs on the various local anesthetics had been published. The entire subject of local and regional anesthesia was first presented in that year in a large volume by Dr. Carroll W. Allen[1].

Matas, in his introductiou to Allen's book says: "Great transformations have taken place in our method of narcosis. Chloroform which for half a century had reigned supreme as the autocrat of the operating theatre has been practically banished from the clinics of the South, its last stronghold.

"The problem of shock, secondary nausea and vomiting, the pulmonary complications, embolism and thrombosis, and above all the degenerative auto-intoxication following the action of these somatic poisons on the eliminating and other organs, still remain to be reckoned with.

"On the other hand, the synthetic chemist and pharmacologist have not been idle, and their untiring and brilliant efforts to find substitutes for the dangerous and costly Cocain, have given us a succession of the remarkable synthetic products to be themselves displaced in turn by what now appears to be the nearest approach to the ideal local analgesic, Novocain.

"The art of local and regional anesthesia is still young; it is still in process of development, still offers many difficult problems that await solution."

Allen (loc. cit.), calling attention to the fact that chloroform was discovered in 1831, Ether in 1842, Cocain in 1884, says: "Had local anesthesia been discovered first, general anesthesia might now be struggling to replace it from its coveted pedestal, and it is not to be doubted but that local anesthesia would have reached a much higher plane of development, for in all operations suited to its use, general anesthesia cannot compare with it, in safety and comfort. The survival or failure of any method advocated for practical daily use must rest entirely upon the clinical results obtained. The prime object of all surgery as well as all medicine, is the relief of suffering, and the prolongation of life; those measures which obtain these ends with the least disturbance to the patient and the least suffering must ultimately prevail to the exclusion of all harsher and less agreeable." In the hospital service of Dr. Matas and Dr. Allen, fully 55 per cent to 65 per cent of the major operations are performed solely by peripheral anesthesia.

Shambaugh[2] in an editorial comment, says: "To depart from local anesthesia in nose and throat operations, is a step in the wrong direction."

Thompson[3] in writing of local anesthesia for tonsillectomy, says: "For complete removal in children, only general anesthesia should be considered, but this is seldom necessary in adults."

Mosher[4] writing of the activities of the Section of Oto-Laryngology in the late War, says that most tonsillectomies are done under local anesthesia. Many conversions occurred to the use of local anesthesia and the author implies his own partial conversion. He had expected deaths to be reported from post-operative hemorrhages, when done under local, but none had been.

Dowman[5] states that Thomas and Cushing reported the removal of a brain cyst under Cocain anesthesia after four previous operations under general anesthesia had been abandoned on account of excessive hem-

orrage due, presumablyq, to the fulness of the vessels produced by the anesthesia.

The say, "Although the undertaking was premeditated, in consequence of our previous unfortunate experience in administering general narcosis to this patient, we must confess to surprise at its successful accomplishment. Contrary to all expectations the dura proved to be insensitive to such manipulations as were necessary to open it freely. Only when it was put under tension or displacement was any discomfort occasioned, otherwise it seemed to be absolutely free from sensitivity."

The more general application, however, in the use of local anesthesia in operations for cranial and brain injuries as the result of war wounds was urged by Colonel Cray of the British Army in 1917. Also in developing the technic, which was responsible for the reduction of the operative mortality from 60 or 65 per cent, to less than 30 per cent. In head injuries with dural penetration, Cushing adopted the routine use of local anesthesia as one of the important steps in the operation.

In a very intensive experience as Chief of a neurosurgical team working in the forward area during the St. Mihiel and Argonne offensives, Dowman became thoroughly converted to the use of local anesthesia in brain and spinal cord operations. The advantages were so numerous and the disadvantages were so few that he could see no reason why the practice should not be adopted more generally in operations for neurosurgical conditions.

Since returning to civil practice the writer has used local anesthesia as a routine practice in all neurosurgical operations, excepting those on children and on extremely nervous adults whose co-operation could not be relied upon.

RESUME.

Thus presenting the views of the general surgeon together with the opinions expressed by those operating in nose and throat conditions taken from most recent literature, we respectfully submit the advantages of local anesthesia in nose and throat operations.

DISADVANTAGES.

These are claimed to be: Difficulty of control of bleeding at the time of operation; tendency to post-operative hemorrhage, greater than under general; difficulty of sterilization; edema and sloughing; and greatest of all—toxicity.

A careful investigation among many American operators who favor local anesthesia in nose and throat work, and they are by far in the great majority, fails to elicit any unusual difficulty from bleeding at the time of operation, nor any greater frequency of post-operative hemorrhage after local anesthesia than after general. The danger of bleeding following a tonsil enucleation in an adult whose tonsil has already become fibrous is fully considered, and the careful operator bearing this in mind makes this a hospital operation, keeping the patient in bed three to four days thereafter, thus avoiding possible hemorrhage, and having prompt help on hand if needed.

STERILIZATION.

There seems to be no doubt but that occasionally Adrenalin loses its ischemic effect on boiling, and should therefore be always tested as to its activity.

Ersner[6] states that Novocain is difficult to sterilize.

MacNaughton-Jones[7] has presented an article on the sterilization of local anesthetics which consists in preparing a solution of sodium chloride together with the anesthetic or anesthetics and adrenalin chloride, each constituent being present in such quantity that a dilution with many times the volume of water will give a solution containing the requisite percentage of each. The preparation is placed in a sealed vial or ampoule and kept until required. Sterile water is added immediately before injection.

He prepares a concentrated solution of Novocain as follows:

Novocain	3.25
NaCl	3.25
Adrenalin sol. (1:1000)	8.
Water q. s. ad	25.

This solution when diluted with forty times its bulk of water, contains 3.25 parts per thousand of both Novocain and NaCl, gives perfect anesthesia and has an osmotic pressure approximately equal to a four per thousand (0.4%) solution of the latter salt.

In conversation, Dr. William A. Heckard, a dental surgeon, stated that he had made use of an appartus for the *triple* distillation of water in which Novocain was to be dissolved, and that it had been claimed that this added to its effectiveness. The apparatus had been in working order in the N. Y. Base Hospital No. 5, where a large amount of plastic surgery of the face had been most successfully done. He also gave the name of the originator to whom your Chairman wrote, asking him for any published data as also for any reasons he might give for the *triple* distillation. Although this was asked for in the name of the Committee and the American Medical Association, the courtesy of a reply was not vouchsafed.

EDEMA AND SLOUGHING.

The only local anesthetic which produces edema and sloughing is Quinin-urea-hydrochlorate. So many statements were found in the literature that this anesthetic had been abandoned in other fields of medicine, because of edema and sloughing, that writers who had presented favorable reports on this drug in nose and throat operations were communicated with by your Committee. One writer who had recorded 390 cases of tonsillectomies extolling this anesthetic which he had used for four years and is still so recorded, now states that he has not used it in two years, although no publication has been made retracting the former endorsement.

Still another writer stated that Quinin-urea came nearest the ideal local, now says that he has ceased using it.

As far as nose and throat operations are concerned, this drug has practically gone into "innocuous desuetude."

Crile is recorded in favor of this drug, although C. W. Allen says that he looks forward to the time when the former will abandon this agent.

It is but fair to state that a recent writer extols this drug in the operative treatment of diseases of the rectum, and in a personal communication states that he has not changed his views.

It is to be regretted that this effect obtains because the anesthesia at the time of the operation is excellent and the recovery of the patint seemed to be much smoother with it because the anesthesia remained for several days.

IDIOSYNCRASY.

We have sought most earnestly for anything that might show some reference to idiosyncrasy and have one such reference.

Tobias and Kroner[3] report a case of Cocain poisoning: Female, single, age 43, had been treated for years for tachycardia, excessive perspiration, dysentery. A tooth was extracted, 1 c. c. of a 1 per cent solution of Cocain was used. Soon after injection, twitching of the left facial nerve, both arms and legs. Patient went home with her sister; two hours after injection, pupils dilated, reacted to light, respirations rapid, as also heart action. Complete paraplegia both arms and both legs, of a spastic character. Reflexes of arms and legs much decreased. Patellar and foot clonus. Complete anesthesia of mouth and pharynx. Speech interfered with, also deglutition. Two hours later, arms and legs better, five hours later, again complete paraplegia, face resembling tetanus, lower jaw and facial reflexes greatly increased. Pulse soft and rapid. Two weeks of illness with eventual recovery.

The writers state that while this case shows many of the stigmata of hysteria, these surely could be excluded. Such symptoms could not generally rise in a healthy organism, as long as the internal secretory glands kept the normal balance. Should these be interfered with the poison could easily produce its ill effects without hindrance.

In this case, there was a pre-existing neurosis of the sympathetic, tachycardia, excessive perspiration and tendency to diarrhea. The small dose of the drug ordinarily non-toxic was sufficient to upset the feeble balance of so many years and this, they suggest, may help to explain the term "idiosyncrasy."

TOXICITY.

This chapter is the most important one in the discussion of disadvantages of local anesthesia and merits most careful study and investigation.

We can conceive of nothing more distressing than a death occurring when least expected, within two or three minutes after the injection of a local anesthetic for an operation that is done in the largest number of instances to relieve conditions that may add to the comfort of the patient, thus prolonging life, but not immediately necessary, to which the patients submit at our earnest advice.

It is only by a study of these fatalities that we may hope to obtain a fuller knowledge of the contributing factors and to reach conclusions that may tend to prevent their occurrence.

Because so little is known of this subject and because of its vital interest, our search has been thorough both into recorded and unrecorded cases.

The toxic effects may range from mild symptoms, grave and threatening ones, to sudden death.

COCAIN.

Among recent deaths recorded are: Death following the injection of Cocain, amount not specified, for dental extraction mentioned in the British Dental Journal, 1918, cxix, 198.

An editorial in the same journal for the same year, page 352, cites two recent cases of Cocain poisoning with sudden death.

Other cases of poisoning by Cocain will be presented later in this report.

NOVOCAIN.

In the editorial above referred to, Fischer[9] is mentioned as stating that in a practice comprising over 15,000 cases, he has not had a single serious case of intoxication after injection of Novocain, while he will ever remember the grave accidents after Cocain injection.

RECENT DEATHS AFTER USE OF NOVOCAIN.

Wright[10] reports a case of death following the intraspinal injection of 1.1 grains Novocain. The anesthesia was complete. The prostatectomy finished, patient became nausated and pale with pinpoint pupils, persistent vomiting, thready pulse, pupils contracted for twenty-eight hours, and death occurred.

Shoemaker[11] reports a death after subcutaneous injection of not more than 2½ c. c. of 5% Novocain. Autopsy did not explain death.

Brutt[12] reports a case of sudden death following the use of Novocain. Altogether 0:7 was used. Female, age 29, total deafness since the fourth year, result of glandular disease. There was also disturbance of speech function. Fourteen years previously operated for goiter, well for years thereafter. Has noticed swelling of the neck for several months and for several weeks dyspnea on great exertion. No palpitation, no nerve disturbance, no other signs of Basedow, no other goiters in family. Well built, deaf, speech hard to understand; skin very dry, scaly; face puffy without edema. Neck materially large (40 cm.) as a result of left-sided enlargement of thyroid (rather soft—no fluctuation, mild pulsation). On the right, scar of old operation, no enlarged thymus. A number of large veins extend down from the lower end of right half of thyroid; heart and

lungs normal. Diagnosis: Recurrent struma, probable form of Basedow's. It was decided to excise old cicatrix and resect the remainder of the thyroid. Eight days under observation, shortness of breath only signs, on great exertion. The day before operation and on the same day, Digitalisatum by mouth given (amount not stated). Three-quarters of an hour before local anesthesia Scopolamin 0.0005 Morphia 0.01 injection and then followed hardly 140 c.c. of ½% solution of Novocain. When 30-40 c.c. had been used, patient became pale; as this is not unusual they continued. There was no condition of fear on the patient's part. Five minutes after the local anesthesia was given, the patient lying quietly all the time, the pulse suddenly ceased and also the respirations; face became pale and bluish, pupils widely dilated. Artificial respirations. Heart massage. Camphor injections. Oxygen inhalations. Some return of normal respiration. Superficial respirations after long pauses. Failing to resuscitate, cardiac cavity was opened and direct massage used. The first strong compression of the heart restored for a short time fresh red facial color and pulse could always be felt, no spontaneous heart contraction. Massage kept up for half hour with intravenous injection of 10% oxygenated salt solution to no effect.

Autopsy: Neither status lymphaticus nor hypoplasia of the chromafin system nor any other cause for sudden death found. The small dose of Scopolamin and Novocain (with the usual amount of Adrenalin added) could only be dangerous if some unexplained susceptibility exists.

The writer quotes Nettel on a toxicity following Novocain and asks, "Did the injection get into a large vein?" Many punctures were made, so even if a vein had been entered, it would be with a small dose. *He can find nowhere in the literature a suggestion that danger exists from intravenous injection.*

Death here was due to the heart, evidently an abnormal susceptibility to the drugs used on an unusually bad heart. The lesson to be learned is that the utmost care must be used with this combination of drugs in struma.

(From the Surgical Division of the Eppendorf Hospital, Hamburg.)

TOXIC EFFECTS—NON-FATAL.

Calle-Cottin and Demole[13] record a case of septic meningitis following intraspinal injection of Novocain.

Four hours after the injection of .08 Novocain, symptoms of meningitis appeared, reaching their height the next day, cerebrospinal fluid was cloudy, contained many polynuclears but no micro-organisms. Symptoms decreased on the third day, patient was well on the fifth. The solution was freshly prepared, aseptic precautions carefully carried out nor did the symptoms show infection. They ask was this due to an isotonic solution? They believe that there was a special idiosyncrasy.

Vongaza[14] injected 2% Novocain several weeks old prior to teeth extraction, severe edema of face followed, pronounced hemorrhage from major palatine artery, subsequent palatal perforation. The author feels that bacteria must have grown profusely in the solution of old Novocain and their toxin produced tissue narcosis.

Giffin and Cundrum[15] report a case of Novocain poisoning where 1/12 grain of the drug was injected peridentally combined with 1/800 grain Adrenalin. This patient recovered. Inquiry among a wide circle of friends showed that none of these had ever seen alarming symptoms occur after Novocain.

Flory[16] in 6 out of 100 patients found that there was some kidney irritation after relatively small doses. These may well be due to causes other than Novocain.

Achard[17] in the largest number elimination of Novocain as shown by urinalysis, is between two and three hours, practically finished in the sixth, exceptionally it is slower, the greatest intensity in the second hour. Where the elimination is slow, it is usually accompanied by violent headache.

DEATH FROM APOTHESIN.

Jay Ireland[18] reports a case of death following spinal anesthesia after three grains of Apothesin were introduced, by the French method into the spinal canal (after mixing with spinal fluid) by gravity with the patient in a recumbent position. He was placed in the sitting position, but became cyanotic. Herniotomy was performed. Four hours later the systolic blood pressure was 98, the diastolic 62. Pulse was 60 and was very weak. Three days later, on January 22nd, he was very incoherent and cyanotic, mumbled frequently and had to be restrained. January 23rd: More stuporous and involuntaries occurred. These continued till death. January 24th: The right arm was flaccid and Babinski, Oppenheim, Gordon and Chaddock signs were positive on the right. He moved his lips, but made no audible sound. Motor aphasia was present. January 28th: Left parotid gland was swollen. January 29th: Right facial paralysis developed. February 1st: Slight increased fremitus with crepitant rales, present in the right lower lobe posteriorly. Temperature was 102° F., respiration 32; right pupil was larger than the left; fundi normal. Patient died about six hours after lung signs began. The cause of death was due to cerebral hemorrhage, whether this hemorrhage was due to toxic effects of the apothesin on the cerebral vessels cannot be definitely stated. The fact that the blood pressure was lowered by spinal anesthetics would seem to indicate that it was not due to the usual cause of cerebral hemorrhage, i. e., high blood pressure with arteriosclerosis.

Hamilton[19] mentions Adrenalin as an adjunct to and an antidote for Apothesin. The simultaneous administration of Adrenalin with Apothesin as with Cocain and Novocain, is not for any purpose other than to localize and intensify the anesthetic action, since its stimulating action on the heart and vessels is obtained only by intravenous injection, but the antidotal effect is indirectly affected even from the subcutaneous administration, because adrenalin prevents general absorption of the anesthetic, and by intensifying the action of apothesin makes large doses unnecessary.

The value of adrenalin, therefore, for both purposes to limit absorption and to sustain the heart, is due to its characteristic properties of constricting the blood vessels and acting as a powerful cardiac tonic.

Apothesin is a local anesthetic which is materially less toxic than cocain, and is entirely free from habit-forming effects.

BETA EUCAIN.

Orr[20] found in the literature six severe cases of intoxication reported from the use of Beta eucain. For a Bassini herniotomy 0.25% solution, 3.4 grains given, but leakage was considerable. Patient died. There was some doubt as to contributing cause.

BENZYL ALCOHOL.

Macht[21] finds this drug to have lower toxicity than Cocain group, and as good anesthetic properties. It is quickly excreted, easily sterilized, cheap and satisfactory clinically.

STOVAIN.

Smith and Hatcher,[22] Munchmeyer in 1,189 cases of spinal anesthesia found not more than 70% free from after or by effects. One fatality, seven transient paralysis. Madden reports three fatalities. Hardonin, 16 fatalities. Pharmacological experiments show Stovain distinctly but slightly more toxic than Novocain similarly administered and recovery from it is not so prompt.

PROCAIN.

McMechan.[23] Procain is 1/5 to 1/7 as toxic as Cocain. In subjects of low blood pressure or cardiac disease, Procain should be used with caution on account of its depressing action. Large doses in susceptible individuals may produce tonic and clonic spasm, agitation, and accelerated shallow breathing. The addition of alkali increases very noticeably the efficiency of Procain, and other allied analgesics, because the free anesthetic bases penetrate more readily than do the salts, but this does not apply

to intracutaneous injection. Addition of sodium bicarbonate may be of use for intraneural or subdural, but is definitely useful for surface anesthesia.

NIRVANIN.

No reports are at hand regarding this drug, though its toxicity is exceedingly low.

NEW LOCAL ANESTHETICS (ALLOCAIN).

Kubota.[24] Nagayoshi Nagai isolated an alkaloid ephedrin from a Chinese drug, Ephedra vulgaria Rich, and afterwards obtained a synthetic alkaloid mydratin closely related to ephedrin. These alkaloids have a similar constitution to Adrenalin, and it is claimed that their pharmacological action resembles qualitatively that of Adrenalin.

By introducing into mydratin monoethyl, diethyl and benzoyl groups synthetized secondary local anesthetics, Allocain S. soluble, Allocain A (insoluble).

The object of the author was to obtain a body possessing the local anesthetic properties of Cocain, as also vasoconstricting action like that of Adrenalin. It is claimed for Allocain S. that among other properties it inhibits the growth of strepto and staphylococci. It has been tried on several hundred cases of operations with success.

CLINICAL INVESTIGATION.

In the belief that all fatal cases are not reported, the Council on Pharmacy made an attempt some time ago, to secure some data on the toxic effects of local anesthetics through advertisement in more than thirty medical journals, receiving but two replies. Your Committee had a similar experience through an announcement in the Journal of the American Medical Association and had but one reply and that reply "had nothing to do with the case." Consequently, we prepared a questionnaire seeking information directly from fellow members of this Association and 85% of these answered. While this large number of responses is eminently gratifying, your Chairman regrets that even so small a percentage of the members of this Section could be found who failed to reply to a courteous query on a matter of such vital importance to the profession, as also to themselves, and to their own Committee. We deem it important that attention should be called to this, as we believe that future investigation should result in one hundred per cent answers.

The result of this questionnaire has been exceedingly interesting and valuable. We have not only been able to secure reports as to the anesthetic used, its dosage, etc., but have also many reports as to toxic effects and a record of 20 deaths, most of them not previously recorded.

In dwelling on the question of toxicity in detail, we have done so because these cases are not all recorded, and only by careful examination can we hope to ascertain their causation and prevent their occurrence.

It must be understood that there is no intent to create the impression that fatalities are at all frequent, the percentage must be remarkably low, and the dangers of toxicity will compare most favorably with those of any general anesthetic.

REPLIES TO QUESTIONNAIRE.

To one hundred and fifty representative laryngologists of the United States and Canada, the following questionnaire was submitted:

1. What method of local anesthesia do you use for operations upon the nose.
2. On the throat?
3. Do you use an anondyne first, if so, what and in what doses?
4. What toxic effects have come under your notice.
5. Do you know of any fatalities? Give particulars.

Answers were received from about one hundred. a few answered briefly, others quite fully and some in considerable detail. The following report is based upon these and consists of a digest rather than a detailed account; the tabulated form will be found at the end of the report.

1. What method of local anesthesia do you use for operations on the nose?

The preference for a strong solution of Cocain (10% or above) applied with cotton applicator or pledgets was marked, about 80% advocating its use. Powdered Cocain, Cocain mud and saturated solutions were used by twenty-six, while very weak solution (1%-4%) found favor among four. Injections of Novocain ¼% to 2½%, Cocain ½%, Apothesin 1% and Procain ½% were mentioned by twenty-two, but most of these used this means to reinforce the applications to the mucosa rather than as an isolated method, although one would gather that several place great stress upon these injections as the sole means employed. One speaks of nerve blocking with Cocain. Serials were used in five instances:

a. 4% Cocain with Adrenalin followed by powdered Cocain.
b. 5% Cocain with Adrenalin followed by 10% Cocain and Adrenalin.
c. 10% Cocain with Adrenalin followed by powdered Cocain.
d. 20% Cocain with Adrenalin followed by ½% Novocain injected.
e. 1-5000 Adrenalin chloride followed by 10% Cocain.

2. What method of local anesthesia do you use for operations upon the throat?

The divergence of views regarding drugs and dosage was even more marked here than in the preceding question. Novocain in varying strengths was advocated by forty-four, ½% to 1% solution in Adrenalin being the most popular, although the degree scaled from ½% to 5%. Cocain from 1/10 to 4% mostly with Adrenalin was used by seventeen and Apothesin from ½% to 5% by fifteen. Procain (American Novocain) was used by three and Anocain by four, while urea quinine had but one advocate. For the larynx, the greatest unanimity was observed in 10-20% Cocain.

3. Do you use an anodyne first, if so what and in what doses?

The answers left one in some doubt whether the anodyne was used before nose or throat operations or both. One would gather, however, that for the most part, anodynes were administered according to condition, i. e., if they appeared to be indicated, the patient being nervous and apprehensive, they were given, otherwise not. Certain operators made their administration previous to operation, a routine procedure but these were in the great minority, others prescribed them p. r. n. as stated above and not an inconsiderable number appeared to dispense with anodynes altogether, while one or two expressed themselves forcibly against their use. Morphia and Atropia were the overwhelming favorites, both or nose and throat work. Hyoscine and Scopalamin were used in about six instances. Codein, Heroin, Sodium bromide and others were only occasionally advocated.

4. What toxic effects have come under your notice?

NOSE.

Paleness, nausea, giddiness, symptoms of faintness, profuse perspiration (Butler).

Sudden paleness, rapid pulse, faintness which disappeared on keeping patient's head in lowered position for a few moments (Skillern).

Psychical only (Mackenzie).

None since waiting 20 minutes (Ridpath).

Slight nausea, sweating, rarely vomiting (Canfield).

Occasional faintness, stiffness of forearms and fingers, thumbs drawn across palm, increased pulse and respiration (Chamberlain).

Typical poisoning from Cocain in flakes (Beck).

Few instances from Cocain, faintness, oppressed breathing, weak pulse, numbness in arms and legs, flexion of thumbs and hysterical symptoms (Dennis).

Occasional cases of syncope (Hubbard).

Collapse, slow, thready, weak, irregular pulse, dyspnea, pallor, lividity of mucous membrane (Friedberg).

Rapid, feeble, nervous excitement and alarm, faintness (Crosby Greene).

Apothesin produced mild symptoms similar to Cocain poisoning in two cases (Lockard).

Cocain 2% preliminary to anesthesia for irrigation of antrum, complete collapse, Cheyne-Stokes breathing, deep coma for four hours, final recovery (Lockard).

Occasional fainting which has not recurred since using the recumbent position for operating (Haskin).

Faintness and occasional nausea with cold sweat (Thurber).

Slight constriction to breathing, increased respiration, dilated pupils, nervousness and excitability (Levy).

Profuse sweating and feeling of faintness during first few minutes (Barnes).

Tendency to faint in some cases (Craig).

Occasional dizziness, feeling of faintness and silght nausea (Holliday).

Great interference with respiration, cardiac failure, patient nearly died from injection of ½% Anocain.

Transitory pallor and faintness (Mackenzie).

In several hundred septum operations, about 60% felt faint (Alexander).

Marked depression even with 5% solution cocain (Wishart).

THROAT.

Effects from ½% solution cocain (Eves).

Effects from Apothesin 1%, neurotic woman, pulse became very feeble, convulsion, unconscious 2 hours (Lewis).

Affects from Novocain 1%, sudden pallor, weakness, pulse feeble, semi-comatose one hour (Lewis).

Occasional sweating with nausea when stronger Adrenalin was used, headaches, sometimes severe (Canfield).

Mild cases from Novocain (Dean).

Acute delirium following removal of papilloma of larynx (Chamberlain).

Fainting, nausea, rapid pulse, clammy skin, largely obviated by keeping patient reclining or semi-reclining during cocainization and operation (Roberts).

Patients sometimes get talkative and a few a little depressed (Dudley).

Some pallor and faintness at times during tonsillectomy (Hastings).

Cocain poisoning, case cauterization of larynx and case bronchoscopy (Guggenheim).

Apothesin injection 2%, complete collapse, unconsciousness, intermittent contractions of all muscles, Cheyne-Stokes breathing for one hour (Lockard).

Tendency to syncope in a few cases (Royce).

Paleness, increased heart action, 3 cases became unconscious for 2 minutes, 2 cases vomited (Campbell).

Many believe that fear and apprehension play a large role in the appearance of so-called toxic symptoms (faintness, trembling, hot and cold flushes, increased pulse, etc.), others state that waiting twenty minutes before commencing the operation will avoid these symptoms. It would appear that anemia of the brain played an important role as lowering the head invariably brings quick relief. An excessively hot operating room will strongly predispose to bring out these symptoms.

5. Do you know of any fatalities? Give particulars.

NOSE.

a. Weak solution Procain and Adrenalin into septum of nose.
b. Injection 10% solution Cocain in septum (mistake for 1% solution).

THROAT.

1. Novocain injected.
2. ½% Cocain in Adrenalin, 1-10,000.
3. ½% solution Cocain (2 deaths).
4. 1% Cocain in Adrenalin, 1-1000, equal parts.
5. Injection 5% solution Cocain (instead of swabbing).
6. ¾% Novocain, injection with 1-30,000 adrenalin into peritonsillar tissue.
7. 10% Cocain injected (mistake for 1% Procain solution).
8. 20% solution Cocain in larynx.

9. 10% Cocain injected around tonsil (mistake for 1/10% solution Cocain.
10. Cocain and Adrenalin injection, strength not stated.
11. 1/5% Cocain in Adrenalin injected, death in one hour.
12. Injection ¼ gr. Cocain into anterior pillar, death in four minutes.
13. Injection ½% Novocain.
14. Injection 2% Cocain with equal parts Adrenalin full strength.
15. Cocain applied to throat and epiglottis.
16. ½% Novocain injected around tonsil.
17. 20% solution was injected instead of ½% Cocain.
18. ½ of 1% solution Novocain injected after painting with 10% Cocain.

1. No further details. No amount stated.
2. Large fat girl of about twenty for tonsillectomy. About three drops of solution said to have been injected, immediate death. ½% Cocain in Adrenalin 1-10,000.
3. (a) A girl of about twenty with severe endocarditis. Injection of tonsil, immediate death. Autopsy: large vegetations in heart, interference with valve action. Heart stopped in systole. ½% solution Cocain—2 deaths.

(b) Officer of twenty-five previously operated (submucous and ethmoid) without toxic effect. One tonsil injected, immediate death. Autopsy: marked enlargement of thymus with general glandular enlargement. 1.2% solution Cocain.

4. Injection of twenty minims of equal parts of 1% Cocain and Adrenalin 1-1000 for tonsillectomy. The patient became faint and died in less than three minutes.
5. No further details. Injection 5% solution Cocain instead of swabbing.
6. Immediately following injection of less than 1 dram into peritonsillar tissue great apprehension, air hunger, convulsive movements succeeded by cessation of respiration and gradual cessation of pulse. ¾% solution injection Novocain 1-30,000 Adrenalin into peritonsillar tissue.
7. No further details. 10% solution Cocain injected, mistaken for 1% Procain solution.
8. 20% solution Cocain in larynx. Patient died almost instantly after application.
9. Robust man about 43. After two syringefuls fell to floor unconscious and died in spasm in few minutes. (Mistake of druggist.) 10% Cocain solution injected around tonsil, mistaken for 1/10% solution.
10. Patient man of about 28, had an attack of angina pectoris and died two hours after operation. Autopsy showed fatty degeneration of heart muscle. Cocain and Adrenalin injected, strength not stated.
11. Patient received in all about 2 drams. 1/5% Cocain Adrenalin injected, death in one hour.
12. No further details. Injection ¼ grain Cocain in anterior pillar, death in four minutes.
13. Woman 30 years. Local application of Cocain 10% followed by injection Novocain ½% with 8 drops Adrenalin to 4 drams. One dram injected into each tonsil. First tonsil removed when patient gasped and died.
14. Woman 21 years. Three syringefuls injected under the mucous membrane of each faucial pillar. Injection 2% Cocain with equal parts Adrenalin 1-1000.
15. No further details. Cocain applied to throat and epiglottis.
16. Woman 25 years. Injection about 100 minims ½% Novocain with 2 drops Adrenalin chloride. After about 3 minutes a slight convulsive movement involving head and neck was noticed followed in a few seconds by one more severe attack including shoulders, chest and upper arms. Tightly closed jaws, dilated pupils, fixed gaze, wide palpebral fissures, stertorous breathing, moderate but soon marked cyanosis, passing of the

violent convulsive seizures into a marked and general tremor. Cardiac action 120, complete respiratory paralysis in ten minutes. Cardiac action continued some time.

17. Injected into tonsil, the patient dying instantly. (Mistake of druggist.) 20% solution Cocain injected instead of ½%.

18. Soldier, name unknown, aged about 23. Place, Base Hospital 27, France.

Patient not specially prepared, that is, he was given no cathartic night before and was allowed breakfast morning of the operation.

About 10 a. m. or ½ hour before operation, Morph. Sulph. gr. 1/6 was given hypodermically. Fifteen (15) minutes before walking about 100 feet from one building to another, pharynx and fauces were swabbed with Cocain 10% by the head nurse, who did this routinely.

After patient entered the operating room, throat was again swabbed with Cocain 10%.

After waiting a minute or two, injection of a ½ of 1% solution of Novocain (French preparation) was started, patient in the sitting posture and while this was being done patient was suddenly seized with what appeared to be an epileptic attack.

Convulsive seizure lasted about 1½ minutes, followed in a few seconds by another of shorter duration, which in turn was followed by six and finally death in about 4 to 5 minutes.

Comment: Patent received about 5 drams of a ½ of 1% solution novocaine or roughly 1½ grs.

Operation had not been started.

After taking his seat in the operating room and before Cocain was applied the second time, patient was quite pale, and the writer is inclined to think that the additional Cocain and Novocain served as the last straw, although it was the opinion of the Committee that reviewed the case that Novocain probably entered a vein.

Solution out of the same bottle was used on another patient a short time before.

It is not known whether or not patient was an epileptic.

A review of these fatalities, 21 in all, 2 in nose operations, 19 in throat operations, shows that 15 occurred as the result of the administration of Cocain, 5 from Novocain and 1 from Procain.

Of the Cocain deaths, 5 were due to avoidable mistakes. The remainder died within a very short time, as a rule after the administration of the drug, 3 minutes being the usual amount of time.

Some of these cases have already been recorded, and there is no means at hand of ascertaining the proportion of deaths occurring as compared to the number of cases in which local anesthesia was used. As deaths have been recorded following rapid injections of Adrenalin in 1 to 1,000 solution, we have carefully gone into this question, but find no evidence at hand that Adrenalin in these cases was a causal factor. In many no Adrenalin is mentioned—in others, weak solutions.

It having been claimed, from very reliable sources, by most competent observers that the previous administration of Morphia added greatly to the lasting effect of the local anesthetic, made the patients much more comfortable, requiring less of the local anesthetic, probably materially lessening its dangers, this subject was included in the questionnaire, and animal experimentation made to help elucidate it.

About three-fourths of the replies received from clinicians indicated that Morphia was used as occasion required, only a small minority using it invariably before operation. A few objected to it entirely, mainly on theoretical grounds. Those who have used it invariably have expressed themselves as agreeing entirely with the suggestion of Crile in his Anoci Association and it was ascertained from Professor Hatcher that he had made the following experiment:

"A cat was given a poisonous dose of chloral hydrate, replaced in its box and slept off its effects. Another was given the same dose and

fastened to a board, when it promptly died." This would indicate that excitement might be an added danger, which Morphia would tend to subdue.

Your Committee appends herewith a brief resumé of recent Pharmacological Studies on Local Anesthesia:

Recently Sollman[25] has investigated several of the local anesthetics with reference to their relative anesthetic activity and the influence upon this activity of the addition of alkalies, epinephrin, and other agents. The results of these investigations are summarized in a paper published in the Journal of the American Medical Association[26]. His work shows that for intracutaneous anesthesia the hydrochlorid of Cocain, Procain (Novocain), Tropacocain, and Alypin are about the same in effeciency; Beta eucain hydrochlorid is about half as efficient; Quinin-urea hydrochlorid about one-fourth, and Apothesin about one-eight as efficient. When applied to the cornea the hydrochlorids of Cocain and Holocain are about equally efficient; that of Beta eucain one-half; those of Tropacocain, Alypin, and Quinin-urea about one-fourth; Apothesin one-eighth; and Procain (Novocain) one-sixteenth as efficient as Cocain. Slightly different relative efficiencies are obtained by other methods of testing, but none of these methods gives results which are comparable to those which may be expected from the clinical use of the drugs in man.

By infiltration the action is induced almost immediately, but when applied to the surface, as to mucous membranes, Tropacocain, Alypin, and Quinin-urea were the most rapid; Beta-eucain was intermediate; and Cocain, Procain, and Holocain were the slowest. For surface anesthesia (rabbit's cornea) the duration of anesthetic action was found to be from ten to fifteen minutes with Cocain and Tropacocain; from twenty to thirty minutes with Alypin, Beta-eucain, and Holocain; fifty minutes for Procain; and sixty-five minutes for Quinin-urea.

Gros found that the addition of alkali to the local anesthetics increases their anesthetic efficiency as tested on the motor fibers of nerve trunks. Sollmann confirms this and finds that this increased activity also involves the action on the sensory fibers of nerve trunks and the action of the anesthetics when applied to the surface, as on the rabbit's cornea or the frog's skin. This increased activity, or potentiation, by alkali is due to the liberation of the anesthetic base which penetrates more readily than the sale. No such potentiation occurs when the anesthetic is used by infiltration, and the addition of alkali serves no useful purpose for in filtration anesthesia. The addition of an equal volume of 0.5 per cent solution of sodium bicarbonate to a solution of Cocain for surface anesthesia increases the activity of the Cocain from one to two times; the activity of Beta-eucain is increased two times; Procain from two to four times; Tropacocain and Alypin four times. This effects a marked saving in the amount of anesthetic drug used.

The addition of Epinephrin to the local anesthetics does not increase their anesthetic activity, but for infiltration it greatly prolongs their action by prevention of absorptive removal.

A one per cent solution (isotonic solution) of potassium sulphate or chloride has some anesthetic action, but too little to be of value alone. It is an advantage, however, to substitute such a solution for sodium chlorid in preparing solutions of the local anesthetics for infiltration anesthesia.

The pharmacology of the local anesthetics has also been investigated recently with special reference to the causes of intoxication, the elimination of the drugs from the animal body, and the possible measures of combating intoxication. The data are to be found in the following pa-

pers: Hatcher and Eggleston,[27] Smith and Hatcher,[28] Eggleston and Hatcher,[29] and Eggleston and Hatcher,[30] from which the following is abstracted.

Fig. 1		Mgm. x kgm.	Solution Per cent.
Procain	——	40-45	5-20
Nirvanin	———	30-35	10
Stovain	———	25-30	10
Tropacocain	———	18-22	10
Apothesin	———	20	5-10
Cocain	———	15	5-10
Beta-Eucain	———	10-12.5	5
Alypin and Holocain	———	10	5-10 1-2

Relative toxicity and range of concentration of solutions for the several local anesthetics; fatal doses in milligrams per kilogram.

The symptoms of intoxication produced by the local anesthetics are closely similar in both man and the lower animals, especially the cat. The toxic phenomena produced by the different local anesthetics are also closely similar. The maximum toxicity of the local anesthetics can be determined on the cat by the rapid intravenous injection of concentrated solutions, and the relative toxicity as determined in this manner is shown in the accompanying chart, *Fig. 1*. It is further found that all of the local anesthetics are mutually and quantitatively synergistic so far as their fatal actions are concerned.

With slow or repeated intravenous injection, the cat can withstand several times the fatal vein dose of all of the local anesthetics excepting Cocain and Holocain. This is due to the rapid elimination of the local anesthetics.

With subcutaneous injection into the cat the toxicity of the local anesthetics depends upon the ratio between their rates of absorption and of elimination. Thus, five or more than five times the minimal fatal vein dose of Alypin, Apothesin, Beta-eucain, Nirvanin, Procain, Stovain, and Tropacocain can be injected subcutaneously into the cat without causing death. Four, or less than four times the fatal vein doses of Cocain and Holocain similarly injected prove fatal. If Epinephrin be injected subcutaneously simultaneously with the local anesthetics, their toxicity is greatly reduced by delay in their absorption. This reduction of toxicity is much less marked in the cases of Cocain and Holocain than with others of the group, due to their much slower essential elimination.

The various local anesthetics are absorbed from the mucous membranes of the nose and pharynx of the cat no more rapidly than from the subcutaneous tissues, and the urethra, bladder and vagina resist the absorption of these drugs to a great extent.

The elimination of the local anesthetics in the cat is shown to be through their rapid destruction in the liver, and this takes place in the excised, perfused organ as well as in the liver of the intact animal.

Severe acute hemorrhage and narcosis by hydrated chloral are the only procedures by which the toxicity of the local anesthetics for cats could be increased, and the increased toxicity seems probably to be due to a diminution in their rate of destruction in the liver through an impairment of the circulation.

All of the local anesthetics are synergistic with epinephrin on the blood pressure in a manner analogous to Cocain, when injected intravenously.

The use of artificial respiration, combined with stimulation of the heart by the intravenous injection of epinephrin, is capable of saving cats from death following the intravenous injection of as much as twice the average fatal vein dose of the local anesthetics. Similarly, the stimulation of the heart by the previous injection of Ouabain permits the cat to recover from intravenous injections of nearly twice the average fatal dose of any of the local anesthetics, when the temporary paralysis of the

respiratory center is combated by means of artificial respiration. The success of both of these measures rests upon the rapid destruction of the anesthetics by the liver.

All of the local anesthetics kill the cat by immediate and simultaneous paralysis of the heart and the respiratory center, the action on each being independent of that on the other.

The relative toxicity of the local anesthetics cannot be stated in figures, since it depends upon the mode of administration, the rate of absorption or entrance into the blood stream, and the rate of destruction in the liver.

The simultaneous employment of epinephrin with the local anesthetics for infiltration anesthesia is of value, not only in prolonging the anesthetic action, but in diminishing the danger of intoxication by delaying absorption. The danger of intoxication by the local anesthetics is more effectively reduced in the cases of all of the other locals than in the cases of Cocain and Holocain, because these are less rapidly destroyed in the liver than are the others.

ANIMAL EXPERIMENTATION MADE FOR THIS INVESTIGATION.

"Department of Pharmacology Cornell University Medical College, New York, December 13th, 1919.

Dear Dr. Mayer:

I have performed a few experiments on dogs and rabbits, using Procain, without, and with Morphin and Atropin. on dogs by intramuscular injection of small doses of Procain (25 milligrams per kilo) and on rabbits by intravenous injection of the same amounts. They afford no evidence that these alkaloids have any marked influence on the toxicity of Procain (or Novocain), though Morphin does certainly have some effect in modifying the severity of the convulsions, and probably on the rate of complete recovery following such large intravenous doses.

I speak of this as a large intravenous dose, though it is the same dose per kilo as that used intramuscularly, in which it is in effect a relatively small dose, as it produces no perceptible effect when injected intramuscularly.

Yours very truly,

(Signed) ROBT. A. HATCHER."

PROTOCOLS.

Local Anesthetics: Procain with Morphin and Atropin: Dogs: Intramuscular. December 17, 1919.

1. White and brown mongrel, male, wt. 4.46 kilos. 4.46 p. m. Injected 25 milligrams per kilo intramuscularly, in 5% sol. there was no perceptible effect, animal remained normal.

2. Male, mongrel, brown, wt. 3.94 kilos. 4:08 p. m. Injected intramuscularly 0.2 mg. atropin sulph. x kg.; with 10.0 mg. morph. sulph. x kg. Animal became somewhat depressed, showing usual effects of morphin, but no emesis; some salivation. 4:50 p. m. 25 mg. procain (novocain) x kg. in 5% solution intramuscularly, animal remained quiet showing effects of morphin but none other. 9:00 a. m. (Following day.) Animal appears quite normal.

3. Male, mongrel, white and black, wt. 3.14 kilos (somewhat emaciated). 4:13 p. m. Injected 10 mg. morphin sulph. x kg. 2% sol. intramuscularly, effects much as in preceding. 4:52 p. m. Injected 25 mg. novocain (procain) 5% sol. intramuscularly. 5:15 p. m. There has been no perceptible effect (results as in preceding). 9:00 a. m. (Following day.) Animal appears to be quite normal.

The foregoing would seem to indicate that Morphin alone, and Morphin with Atropin in moderate doses, does not influence the action of Procain when injected intramuscularly in such a way as to afford any explanation of accidents often observed when it is used therapeutically.

These experiments have no bearing on the question whether Morphin alone, or with Atropin increases or diminishes the toxicity of Procain for

dogs, except insofar as they indicate that Morphin and Atropin do not increase the toxicity after intramuscular injections to any extraordinary degree.

Local Anesthetics: Procain with Morphin and Atropin: Rabbits, intravenous. Atropin 1-1000; Morphin 1-50; Procain 1-20. December 18, 1919.

1. Brown male, 0.87 kilo. 9:55 a. m. Injected into ear vein, 25 mg. procain in about 5 seconds. Convulsions in about 30 seconds; violent. Animal sat up after about 7 minutes and appeared normal in 15 minutes. 10:43 a. m. Injected into ear vein 2 mg. morphin sulph. and 1 mg. atropin sulph. x kg. Animal became greatly depressed at once, sitting with head to floor; easily aroused, but sinks down at once when undisturbed. 10:47 a. m. Injected 25 mg. procain x kg. into ear vein. Mild convulsions almost at once; respiration became very shallow for period of several minutes and animal fully extended. 10:53 a. m. Able to get up, but falls when attempting to hop about. 11:40 a. m. Sitting up in cage, slightly depressed. Recovered gradually and completely in about 3 hours. (See foot note.)

2. Brown male, 1.14 kg. 10:11 a. m. Injected 12 mg. morphin sulph. x kg. into ear vein. Affects as in preceding. 10:17 a. m. Injected 30 mg. procain x kg. into ear vein. Feeble convulsions at once; respiration became very shallow, animal fully extended. 10:26 a. m. Respiration slow and shallow, eyes half open, nearly fatal. 10:32. Sits on belly—not fully extended as previously; recovering. 11:02. Able to get up but sits quiet when undisturbed. 11:45 a. m. Still flat on belly. 1:20 p. m. Improving, but sits with head to floor of cage when undisturbed. Recovered completely.

3. White and brown female, wt. 1.22 kg. 10:30 a. m. Injected 2 mg. morphin sulph. and 1 mg. atropin sulph. x kg. into ear vein. Sits with head down to floor at once when released; easily aroused to move about. 10:35 a. m. Injected 25 mg. procain x kg. into ear vein. There was no perceptible effect leading to an examination of the ear to determine whether the fluid had escaped from the vein; no edema could be discovered, but effects lead to belief that previous injections had caused some anomalous condition preventing the drug from entering the circulation at once, hence the following: 10:57 a. m. Injected 25 mg. procain x kg. into ear vein with precaution to see that it entered circulation at once. Convulsions at once, but mild as in case of others after morphin. 11:05 a. m. Still much depressed; does not turn over when placed on back with feet pointing upward in very awkward position. 11:40 a. m. Sitting up in case but not so nearly normal as is No. 1 at this time. Gradual and complete recovery with return to normal in about 3 hours.

The foregoing indicate that morphin modifies the convulsions of large intravenous doses of Procain lessening their severity, but that neither Morphin alone, or with Atropin, in the doses used, has any material influence on the toxicity of intravenous doses of nearly fatal doses of Procain in the rabbit.

Note: Rabbit No. 1 had a large tumor over the forehead but appeared normal otherwise. After having been apparently normal it was observed to be dying at 2:45 p. m. and was found dead a little later.

Local Anesthetics: Morph. Atropin, Cocain: Cats; Vein and subcut. January 16, 1920.

1. Male grey striped; 3.16 kg. 11:08 a. m. 10 mg. morph. sulph. x kg. 1-50. 1 mg. atrop. x kg. 1-1000 subcut. 1:28 a. m. Shows little effect of morphin (of, No. 2). 11:31. 45 mg. cocain HCl x kg. 1-20 (equivalent of 3 times fatal vein, injected subcutaneously. 11:36 a. m. Becoming restless (morphin action). 11:50 a. m. Mild general clonic convulsions. 1:00 p. m. Frequent spasmodic twitches; quiet in intervals. 3:29 p. m. Sudden violent general clonic convulsions. 3:40 p. m. Condition closely resembles that of No. 2 at 11:28. 4:32 p. m. Convulsions as at 3:29. 5:02. Convulsions as at 3:29. 6:30. Almost incessant convulsive movements as though suddenly frightened since 5 p. m. 8:00 p. m. Condition much

as at 6:30, but seizures less frequent. Typical morphin action in cat. Pupils are widely dilated; do not react to light (atropin). Jan. 17. 10:00 a. m. Depressed; fatigue from long continued convulsive condition; pupils widely dilated; still slightly hyperexcitable; markedly so in fact, but relatively slight as compared with previous condition. Animal used for another drug experiment.

2. Female, grey stripes 3.38 kg. Jan. 16. 11:10 a. m. 10 mg. morph. sulph. x kg. 1-50, subcut. 11:28 a. m. Typical morphin action—very restless and almost convulsive. 11:33 a. m. 45 mg. cocain HCl x kg. 1-20 subcut. 11:36 a. m. Frequent clonic convulsions. 11:50 a. m. Lies extended; frequent mild clonic jerks. 1:00 p. m. Lies quiet except for occasional clonic jerks. 3:30 p. m. Animal is dead; probably died about 3:00 p. m. Exact moment of death not observed.

Eggleston and Hatcher found that the cat survived. Cocain in doses slightly larger relatively than these, and this would seem to indicate that Morphin alone increases the toxicity of Cocain for the cat by subcutaneous injection, and that Atropin lessens the effect of Morphin, but the dose is at any rate so near the fatal (for Cocain) and the cat that received the Atropin with the Morphin was so nearly fatally poisoned that one is not justified in attributing any marked effect either antagonistic or synergistic to the Morphin and Atropin, or Morphin alone, with Cocain.

Local Anesthetics: Procain after Scopolamin: Rabbits: Vein, subcut. January 16, 1920: Procain 1-10; Scopolamin 1-500.

1. Grey rabbit; wt. 1.76 kg. 3:13 p. m. 2 mg. scopolamin HBr (Euscopol) 25 mg. procain x kg. ear vein, respiration became hurried at once, then animal was somewhat depressed for about 2 to 3 minutes with rapid and complete recovery. 3:25 p. m. Pupils are widely dilated; do not react to light.

2. Grey, wt. 1.23 kg. 3:18 p. m. 2 mg. scopolamin HBr (Euscopol x kg. intramuscularly. 3:21 p. m 100 mg procain x kg 1-10, subcutaneously 3:25 p. m. Pupils dilated not maximal, react slightly to light. 3:40 p. m. Lies fully extended, nose to floor. 5:05 p. m. Appears to be about normal.

Local Anesthetics: Procain after Scopolamin; Cat, vein, subcut. January 16, 1920. Scopolamin HBr (Euscopol) 1-500; Procain 1-10.

1. Female, 1.95 kg. (phenol locally for operation). 2:23 p. m. 1 mg. Scopolamin HBr; 25 mg. procain x kg. vein convulsion at one; respiration interrupted about 15 seconds, followed by rapid recovery. 3:32 p. m. Pupils dilated widely, do not react to light. 5:05 p. m. Appears normal.

2. Female, 2.73 kg. 1:55 p. m. 2 mg. Scopolamin HBr (Euscopol) x kg. intramuscularly. 2:06 p. m. 100 mg. procain x kg. 1-10, subcutaneously. 2:14 p. m. Emesis. 3:25 p. m. Pupils dilated not maximal, react slightly to light. 5:05 p. m Animal is somewhat hyperexcitable; otherwise appears nearly normal.

SECOND SERIES OF EXPERIMENTS.

"Department of Pharmocology, Cornell University Medical College, New York, March 6th, 1920.

Dear Dr. Mayer:

I enclose the protocols of several experiments in which six doses of Procain were administered to rabbits (in addition to those already reported to you) and these confirm the observation made previously that the use of Morphin causes the convulsions following the intravenous injection of Procain to be either milder or of shorter duration. It is plain, however, that this effect results from the depression, caused by the Morphin, and that this depression is added to that of the Procain with the result that recovery is slower and the danger of death is increased.

In view of the fact that such large doses are used and the difference is so slight and not absolutely uniform, I believe that the observation has slight value. The results certainly do not, point to the value of the use of Morphin with the local anesthetics, on the other hand I would

not conclude from these results that Morphin is necessarily contraindicated. The fact that Morphin depresses the respiratory center, taken with the fact that the various local anesthetics also cause depression, and paralysis with large doses, of respiration certainly enjoins circumspection with reference to their simultaneous use, and I believe that a very definite need of Morphin would alone justify its use previous to, or with, these local anesthetics.

Yours sincerely,

(Signed) ROBT. A. HATCHER."

PROTOCOLS.

Local Anesthetics: Procain and Morphin: Rabbits. March 5, 1920.

4. Brown rabbit, 2.33 kg. 11:33 a. m. 30 mg. procain x kg. in 10 parts N. S. into ear vein at once. Animal released at once, fell on side. Moderate convulsions. 11:27 a. m. Begins to raise head from floor (first signs of recovery). 11:31 a. m. Sits up on belly, but head to floor. 11:33 a. m. Begins to hop about, nearly normal. 11:47 a. m. 12 mg. morphin sulphate x kg. in 50 parts N. S. into ear vein; when released the animal sits quiet with head to floor after about two minutes. 11:52 a. m. 30 mg. procain x kg. as previously. Released at once, slight convulsion then lies on side fully extended convulsion was somewhat more severe than previously but briefer. Animal assumed unusual position with hind leg pointing upward, remaining in this position about on hour. 3:30 p. m. Sits with belly flat to floor and head down when not disturbed, but able to hop about; returned to cage. 12:02 p. m. Respiration shallow, 20 per minute.

5. White rabbit, 2.37 kg. 11:21 a. m. 2 mg. morph. sulph. x kg. in 50 parts N. S., ear vein Sits quietly when released, otherwise no perceptible effect in 5 minutes. 11:36 a. m. 30 mg. procain x kg. in 10 parts N. S. ear vein, only feeble convulsive twitchings, then lies fully extended. 11:38 a. m. First signs of recovery, raised head. 11:49 a. m. Flat on belly, head nearly down to floor, able to raise it when stimulated. 11:55 Dozing. 12:02 a. m. Lies flat, respiration about 100 per minute. 12:56 a. m. Lies flat, head to floor. 1:55 a. m. Lies quiet, but able to get about. 3:30 a. m. Hopping about floor, appears normal.

Local Anesthetics: Procain and Morphin: Rabbits. March 5, 1920.

6. Brown rabbit, 2.3 kg. 2:45 p. m. 25 mg. procain x kg. into ear vein in 10 parts N. S. at once. Released; convulsion at once lasting about 1 minute, normal in about 10 minutes (apparently, at least). 3:13 p. m. 2 mg. morphin suphate x kg. into ear vein in 50 parts N. S. Slight depression, little more than sufficient to cause animal to remain quiet. 3:18 p. m. 25 mg. procain per kg. as previously. Feeble convulsion at once on being released. 3:25 p. m. Lies on side fully extended; complete muscular relaxation. 3:28 p. m. Lies flat on belly, head to floor, muscular relaxation less than at 3:25. 4:10 p. m. Condition almost the same as at 3:28. Gradual return to normal. Depression of respiration shown in shallow breathing.

7. Brown rabbit, 1.66 kg. 2:12 p. m. 12 mg. morph. sulph. x kg. as in preceding. 2:13 p. m Beginning depression; head to floor after half minute 2:19 p. m. 25 mg. procain x kg. as in preceding exp. Only slight convulsive tremors, respiration ceased. 2:20 p. m. Few respiratory movements in a group. Artificial respiration. 2:23 p. m. Heart beating feebly, gradually failing despite artificial respiration.

These experiments on rabbits with Procain alone and with Morphin, and with Morphin and Atrophin, show that the Morphin, and Morphin and Atropin cause severe depression even with doses as small as 2 mg. Morph. sulph., or this amount with 1 mg. Atropin sulph. (all doses per kg.) and that with doses of 12 mg. morph. sulph. the respiratory depression is profound and lasting.

The convulsions following the adminisration of Procain are *usually* less intense or less persistent in those rabbits which have previously had such large doses of Morphin, but the depression is far more lasting and the fact that the convulsions are less is no indication for the simultaneous use of Morphin, on the contrary, recovery is not so rapid and one rabbit

died from a dose of 25 mg. of Procain; a result that did not follow in any case of a normal animal so far as I recall, and certainly the death of this animal strongly suggests that the simultaneous use of Morphin adds to the respiratory effect of Procain. The heart continued to beat for several minutes after the respiration had ceased, but artificial respiration was without avail. The cause of death in man following small doses of Procain may be independent of paralysis of the respiratory center, and in such cases it may be that the simultaneous use of morphin is not injurious.

COMMENT.

The result of these investigations as to the use of Morphia is rather negative. If anything, it shows that the cat succumbs more readily to a poisonous dose of both drugs. In the human being there is in many instances a state of apprehension to operations, which, if allayed by Morphia, might be of value. Hence we believe that its use is not contra-indicated and should be further tried.

COMPARISON OF LOCAL AND GENERAL ANESTHESIA.

Your Committee finds that local anesthesia is the method of choice by practically all American rhinologists, there is less hemorrhage, far greater safety especially when operating near the cribiform plate, and the dangers of toxicity will compare favorably in the use of the local anesthetic in preference to any general anesthetic. Even the Nitrous oxide and oxygen combination, looked upon by many as absolutely safe, has a record of deaths that destroys that assuredness, one observer has reported 37 deaths from this "safest" anesthetic.

In throat operations the unanimity is not so great, a small minority adhering to general anesthesia, for greater rapidity in work and ease and comfort to the operator.

The majority operate under local anesthesia and declare themselves to be entirely content therewith.

The ideal anesthetic having the effects of Cocain and absolutely non-toxic has not been found, and we realize that the successful anesthetic of today may be discarded on the morrow, nor are we averse to the reporting of those which seem successful at the moment, but we deem it essential that once having so recorded and endorsed it, especially if unqualified, that the same publicity should be made in the event that one has ceased using the drug for grave and important reasons.

It should be understood that this entire report refers to *adults only*.

SUMMARY.

As a result of the study of the literature, clinical experiences and animal experimentation, we conclude:

1. That there is a remarkable similarity in the clinical effects and animal experimentation.

2. That none of the synthetic products equals Cocain in its local effect when applied to the mucous membrane.

3. That these synthetic products may be freely injected if slowly done, in proper doses in unlimited quantities.

4. That fatalities either occur immediately or not at all.

5. That the drug is eliminated in the liver.

6. That the greatest danger lies in too rapid injection or entering a vein.

7. That a peculiar susceptibility which we term idosyncrasy does exist, as the drug enters into the circulation so rapidly that death is almost immediate.

8. That a further study of the toxicity of these local anesthetics will result in definitely establishing the causes of death.

9. That local anesthesia is undoubtedly the choice of methods by all American rhinologists in nose operations.

10. That it is also the choice of a very large proportion of American laryngologists in throat operations.
11. That there is a small number who believe that tonsil operations particularly are best performed under general anesthesia.
12. That the dangers of hemorrhage during tonsil operations under local anesthesia are no greater than under general.
13. That there is no greater danger from post-operative hemorrhage under local than under general anesthesia.
14. That the previous administration of Morphia requires further investigation.

SUGGESTIONS.

Your Committee suggests that all operations be performed with the patient recumbent, beginning with the first application of the local anesthetic, except in sinus operations, where the head and shoulders may be elevated to an angle of forty-five degrees and the table raised so that the proper direction may be maintained.

Each operation to be preceded by a hypodermic injection of Morphia and Atropin and the patient kept in hospital.

In nose operations, application of adrenalin first, followed by Cocain applied and the injection of the synthetic drug *introduced slowly.*

In throat operations applications of a 5 or 10 per cent solution of Cocain, followed by the *slow injection* of the synthetic product.

Where there may be a suspicion of possible danger, one-fourth of the amount of anesthetic to be used at the time of operation should be applied and the patient watched for possible toxic effects.

Among the cases included in these latter are those with evident cardiac disease, Basedow, or other disturbances of internal secretion.

CONCLUSIONS.

Local anesthesia is the ideal method of operating for affections of the nose and throat.

None of the dangers that have been mentioned are any greater than those following general anesthesia.

The question of toxicity has heretofore not been sufficiently studied, and we are grateful to the Council on Pharmacy of the American Medical Association for proposing this investigation, and while the preparation of this report has entailed much labor, practically constant for nine months, your Committee feels that it will not have been in vain if we have thereby added to our knowledge of the causes of fatalities, thus preventing their occurrence in the future; to say nothing of the exceeding value that such formal conclusions will have to some colleague who may hereafter be confronted with one of these most distressing results.

RECOMMENDATIONS.

In order that our work may be constructive, your Committee recommends that a permanent Committee on Toxicity following Local Anesthesia be formed with the Secretary of the Section as a member. That the Secretary mail a copy of these resolutions to each registered member of the Section, asking that reports of fatalities hereafter occurring should be promptly reported to him for further study by the Committee.

This would require the co-operation of every member, and in return, the Committee would pledge itself to present to any participating member the result of its findings in the form of a sworn affidavit for his support in the event of a fatality, thereby preventing possible legal action, at any rate the assurance of co-operation and support from an independent source.

Your Committee further recommends that a change be made from the old method of introducing new local anesthetics.

The method heretofore has been that clinical data were furnished by medical men chosen by the manufacturer, the Council on Pharmacy mak-

ing its studies, and the product then, if favorably reported upon, placed upon the market. We would suggest that clinical investigation should be made by clinicians of our own choosing directly after the pharmacologist has made his investigation.

As such investigation requires much personal attention with careful annotation of the effects of the drug and a reasonably prompt report of the clinical investigation, we would suggest that a fund be placed in the hands of the Therapeutic Research Committee to reimburse properly the physicians who are making these studies, devoting many hours of their time thereto.

In presenting this report, your Committee desires to state that its statements as to the advantages and disadvanages of local anesthesia are entirely impersonal, no one's individual preference is expressed, but rather a composite expression of the views now held by all rhinologists and laryngologists.

No one local anesthetic is favored and a fair and impartial statement is made of the merits or demerits of each.

In presenting suggestions for the methods of operating safely under local anesthesia, we have combined those endorsed by some of the most earnest and active of our colleagues in the profession.

From the great mass of evidence obtained from the writings of and many personal interviews with the clinician and the pharmacologist, we have carefully sifted the evidence and based our statements thereon.

Our recommendations for such improvement as may tend toward a clearer knowledge of the subject than now obtains, and the institution of newer methods in the introduction of new anesthetics, as against the older and more archaic methods are our own and express our verdict after careful study of the mass of evidence we have gathered.

Finally, we recommend the use of the soluble tablets of Cocain for making the solution freshly as required, one to be dissolved in hot sterile water by the operator. Each 240 minims of this solution makes a ½ per cent solution. The unnecessary deaths quoted from "mistake of druggist" or "of nurse" would thus be avoided.

While the work of your Committee has been very laborious during these many months, it has been made easier by the stimulus of the hearty co-operation, encouragement and approval or Professor Torald Sollmann, Chairman of the Therapeutic Research Committee, as also of Professor Robert A. Hatcher, of the Department of Pharmacology of the Cornell Medical College, whose scientific zeal and great willingness to assist and perform new animal investigations have been a source of great inspiration.

Our sincere thanks are due to Dr. Cary Eggleston for his co-operation in assembling the resumé of preceding literature on animal experimentation; to Dr. T. F. Galloway for much assistance in abstracting such literature as was suggested; to the members of this Section whose replies to the questionnaire have been of exceeding value and added much to our opportunities for study; and to the Council on Pharmacy of the American Medical Association who voted a sum of money to defray the incidental and necessary expenses incurred in the preparation of this report.

Your Chairman wishes also to extend his personal thanks to his Associates on the Committee, Dr. Skillern and Dr. Sonnenschein for their aid in promptly assembling the investigations assigned to them and their most hearty co-operation.

If, as a result of our labor we have added to our knowledge of this important subject, eventually resulting in the saving of human life, thus adding to the value of our services to humanity, your Committee will feel itself amply repaid.

1. Allen, C. W. Local and regional anesthesia, 1918.

2. Shambaugh, G. E., Pract. Med. Series 208, 1919.

3. Thompson, J. A., Ohio State Med. Jour., 1917, xiv, 469.

4. Mosher, H. P., Military Surg., 1918, xliii, 631.

5. Dowman, C. F., Jour. Amer. Med. Assn., 1920, lxxiv, 383.

6. Ersner, M. S., N. Y. Med. Jour., 1917, cv, 21.

7. MacNaughton-Jones, M., Lancet, London, 1918, i, 904.

8. Tobias, E. and Kroner, K., Berl. klin. Wochnschr., 1918, lv, 162-164.

9. Fischer, British Dental Jour., 1918, cxiv, 352.

10. Wright, F. R., Jour. Lancet, Minneapolis, 1918, xxviii, 714.

11. Shoemaker, Surg., Gyn. and Obstet., May, 1919, 528.

12. Brutt, H., Deutsch. med. Wochnschr., 1918, xliv, 577.

13. Calle-Cottin, E. and Demole, M. V., Rev. Neurol., Paris, 1917, xxiv, 51.

14. Vongaza, Abstr. in Laryngoscope, 1914, xxiv, 412.

15. Giffin, R. B. and Gundrum, F. F., California State Med. Jour., 1914 xii, 415

16. Flory, P. L., Deutch. Ztschr. f. Chir., 1918, cxliv, 217.

17. Achard, H., Progres. Med., 1919, 3s, xxiv, 70.

18. Ireland, Jay, Jour. Am. Med. Assn., 1920, lxiv, 19.

19. Hamilton, H. C., Surg., Gyn. and Obstet., 1919, xxix, 92.

20. Orr, T. C., Jour. Am. Med. Assn., 1916, lxvi, 1857.

21. Macht, D. I. Jour. Pharm. and Exp. Ther., 1918, xi, 263.

22. Smith and Hatcher, Jour. Pharm. and Exp. Ther., 1917, ix, 231.

23. McMechan, F. H., Clin. Med., 1919, xxvi (2), 105.

24. Kubota, S., Jour. Pharm. and Exp. Thera, 1919, xii, 61.

25. Sollmann, Torald, Jour. Pharm. and Exp. Ther., 1917-18, x, 379; and 1918, xi, 1-9, 17, 69.

26. Sollmann, Torald, Jour. Am. Med. Assn., 1918, lxx, 216.

27. Hatcher, R. A. and Eggleston, C., Jour. Pharm. and Exp. Ther., 1916, viii, 385.

28. Smith, M. I. and Hatcher, R. A., Jour. Pharm. and Exp. Ther., 1917, ix. 231.

29. Eggleston, C. and Hatcher, R. A., Jour. Pharm. and Exp. Ther., 1919, xiii, 433.

30. Eggleston, C. and Hatcher, R. A., Jour. Amer. Med. Assn., 1919, lxxiii, 1256.

THE NEW YORK ACADEMY OF MEDICINE.

SECTION ON LARYNGOLOGY AND RHINOLOGY.

(*Continued from June issue* THE LARYNGOSCOPE.)

DISCUSSION.

DR. HARMON SMITH said that he had referred a number of laryngeal carcinoma cases to Dr. H. H. Taneway of the General Memorial Hospital for radium treatment, some of which had had a preliminary tracheotomy to enable the radium to be placed in contact with the growth. Some years ago this treatment had proved very ineffective for carcinoma, but more recently several cases have improved. The first of these was a case of sarcoma of the naso-pharynx. This case was presented to the section some years ago and the history was published. After several applications of radium the growth diminished to a marked extent. Later the patient left the hospital and disappeared from observation, so that the ultimate outcome cannot be reported. He made marked progress, however, up to the time of leaving the hospital.

Within the last year he had referred to him a patient from South America having all the clinical appearances of carcinoma of the larynx. He received two treatments and has been markedly improved thus far, though too short a time has elapsed to permit forming any definite conclusions. The improvement, however, is very great. The induration of the epiglottis has disappeared, the pain in his ear has disappeared, and he can now speak audibly whereas he could not speak above a whisper before. He seems to be on the mend, and has been advised by Dr. Janeway to return to South America for six months and then come back for further observation, for it will require that length of time to reach any definite conclusions.

On the other hand, however, Dr. Smith said he had not seen any of these cases show marked improvement where a piece of tissue had been removed for microscopic examination and thereby definitely determined to be carcinoma. Fallacious deductions could readily be drawn from this case. Three years ago he had presented to the Section a woman from whose vocal cord he had attempted to remove a specimen for examination and had inadvertantly removed the entire growth. Dr. Wright, Dr. Dwyer, and Dr. Ewing pronounced the case malignant microscopically. The growth recurred and was removed and pronounced less malignant, and a third time when removed it was still less malignant; and the fourth and last time the pathologists have pronounced it only a papilloma. Had this case been subjected to radium treatment after the first examination, one would unquestionably have concluded that it had been cured of carcinoma, for the microscopic examination so declared it and the clinical symptoms substantiated it.

We have now reached the stage where we have to determine whether a growth is one degree or another of malignancy, as unquestionably there are varying degrees of virulence in cancer. A photograph of a painting by a master artist and another of a copy of the same painting will not reveal to the best critic which is that of the master or the copyist, but any able critic of art can easily determine between an old masterpiece and a modern copy, however good the copyist may be; so that in carcinoma as in tuberculosis of the larynx it is the trained eye of the clinician which is to be relied upon more than the findings of the microscope, which reveals all carcinoma to look alike in its sections. If any one man had the opportunity of observing a sufficient number of cases and was keen in noting the clinical aspects of laryngeal cancer, there is no doubt

but that his eye would ultimately become as well trained in differentiation as that of the art critic in the selection of paintings of value from those of spurious nature; and not until the microscopist or the clinician can determine the relative degree of malignancy can we definitely conclude whether or not radium is going to be a cure for deep seated carcinoma or for only the superficial epithelioma, as no means are now at command to determine which is which.

DR. DELAVAN said that, as had been stated before during the evening, radium treatment is still in its infancy, and yet every month brings forth something new and encouraging with regard to it. He could quote many cases seen in the General Memorial Hospital as well as in the hands of others which had turned out fortunately. Several years ago it was the custom to apply radium even in advanced cases of carcinoma of the larynx—cases where edema had taken place in the surrounding tissues of the neck. These cases almost invariably resulted badly; but if the cases are taken early and treated with greater intelligence—as is now being done—the results seem constantly more encouraging.

It will require many years yet to prove the absolute value of this method of treatment, but many cases are most encouraging and give hope of better things to come.

One of the things which should be guarded against is the too frequent repetition of the application of the radium. Of course., the dosage and the duration of the exposure must be carefully regulated.

DR. HARRIS said that there are two important facts to be borne in mind in connection with the use of radium that cannot be emphasized too strongly: one, the need of accuracy in dosage and in application; the other, that radium is an exceedingly powerful drug and should be used and not abused. Even in the hands of the most successful men there is danger of its being over-used. A case now under observation illustrates that. The radium has undoubtedly had a very material benefit on the growth on the cord, but the powerful reaction which took place in the posterior part of the larynx where there was no growth has almost proved fatal—though the patient is now recovering. Radium is not a simple but a most powerful force and should be used with the utmost care.

DR. HURD said he did not know much about the matter of dosage, but it has not yet been well worked out. Last winter he had sent a case of recurring papilloma of the larynx to one of the hospitals in town for radium treatment, which was applied and the papilloma disappeared. The patient, however, received a severe radium burn which resembled an advanced infiltrated tuberculosis, so that at one time it seemed as though it would be necessary to tracheotomize. The man still has an infiltration of the larynx. That was a case that was over-dosed.

Another point is that the secondary fibrosis or infiltrations are often very confusing so that one does not know whether the condition is a recurrence or is due to the use of radium. Last spring he had a case of epidermoid carcinoma of the antrum which showed first in the alveolar process, and was diagnosed by Dr. Ewing. Examination of the antrum resulted in a gush of blood, though two months previously it had been washed out with no evidence of blood. The patient had a slight infiltration of the canine fossa, and in that time this condition had developed. Before operating the alveolar process was bored and the condition was treated with radium emanations; and ten bare tubes were put in all directions through the antrum, putting them where it was though they would be outside of the diseased tissue. The woman was in agony for two months from the resulting radium burn—her face was swollen, her eye closed, and her cheek hung down. After this acute swelling subsided. It could not be decided whether it was a rapid extension, or secondary fibrous from the radium. In September the cavity was opened and cleared out and the upper jaw exenterated. The radium had burned everything; radium near bone will produce necrosis. The wound healed very slowly,

but the patient finally recovered and is now well after three or four months. Some of the radium specialists show a marked tendency to overdosing and producing these secondary infiltrations.

Incidentally, Dr. Hurd remarked that he had taken out nine different specimens and submitted them to Dr. Ewing and none showed evidence of carcinoma.

DR. WILLIS agreed with what Dr. Hurd had said about the over-dosage. The tendency is to expect a very rapid result and to use large amounts of radium as to cause the growth to disappear too rapidly and not protect the secondary tissue. The custom at the Post-Graduate Hospital is to treat the patient rather than the growth, to remove as much of the growth as the patient will stand. Radium is only indicated as an aid. It will never be a cure for carcinoma or for cancer; it is useful only in the cases that are accessible to the rays of radium. One cannot properly place a tube where he cannot join a proper focus unless a proper focus is possible, the result is uncertain. Success depends on over- radiation of the growth and under-radiation of the surrounding tissues; therefore if we have an accessible growth and a patient who can withstand the toxema we have a favorable case for the application of radium.

DR. FORBES said that after having worked with Dr. Harris for ten or twelve years this case was the first unfortunate one they had come across. They had started using radium by direct application with suspension laryngoscopy for papilloma of the larynx, and had seen any number of cases; and though they had not always secured the best results in none of the cases had any injury been caused to the patient or the surgical risk made greater.

He thanked the members for their discussion of this to him interesting subject and begged to again refer to his remarks on presenting these cases; i. e. In the use of radium we have illustrated the co-operative plan of work, X-ray laboratory, radium expert and esophagoscopy.

Osteitis of the Superior Maxillary and Malar Bones. DR. DUNCAN MACPHERSON.

This little boy, aged six, came to the hospital in November with a condition that rendered us unable to say whether he had an acute ethmoid causing an orbital cellulitis or a syphilitic condition, or possibly a sarcoma or osteo-myelitis. The teeth were loose, the nose was discharging and bleeding—it bled very easily. On examination of the teeth, the oral surgeon decided that three teeth ought to be removed. He found some small sequestra in the alveolar process, which were removed. The Wassermann reaction was negative.

In January the boy came back with a swelling over the antrum, and some small sequestra were removed from the anterior part of the superior maxilla. The infra-orbital nerve was destroyed and the greater part of the anterior surface of the superior maxilla was lying loosely in the soft tissues with practically no attachment to them. The nerve passing through the infra-orbital foramen was destroyed.

The condition is supposed to be due to an osteomyelitis of unknown type. The discharge produced no growth on two different occasions, but the boy shows no other evidence of tuberculosis. Owing to density, the bone is not yet ready for microscopical examination. At present the wound is healed and there is no discharge or bleeding from the nose or other indications to show that the disease has not been arrested. The deformity is slight considering the area involved.

Lympho-Granuloma of the Nasopharynx. DR. BEAMAN DOUGLAS.

The patient was a man forty-five years of age who, until ten months ago had been perfectly healthy. At that time a growth suddenly appeared on the right side of the neck. This was treated with radium by some physician, resulting in the sudden disappearance of the growth—so that the man's wife stated it was entirely cured. The patient went along for five months without any symptoms until five months ago he began to

suffer with nasal obstruction and the swelling returned. A few weeks ago he came to the Post-Graduate Hospital. The Wassermann reaction was negative. The blood count showed leucocytes and 80 per cent haemoglobin. Examination showed a growth in the naso-pharynx on the right side involving the sphenoid and infiltrating the right lateral wall of the throat. The enlargement of the neck was then one-third the size as presented. While under observation this growth has rapidly increased—more than doubling in size in one week. A piece was taken from the lateral wall of the naso-pharynx for examination and the laboratory reported lympho-granuloma. The report from the laboratory stated that they were not altogether satisfied with the diagnosis, but that was as near as they could get to it. It was a lymphatic and granulomatous growth coming from the lymphatic membrane of the larynx.

Dr. Douglas said that after discussing the matter he settled upon a diagnosis of lympho-sarcoma; but the next week the man suddenly developed a metastic condition in the left axilla, and within a week the glands were the size of a baseball. Then they wavered between lympho-sarcoma and Hodgkin's disease, but in a few days the glands in the axilla disappeared and now scarcely a trace of them was visible.

Dr. Douglas said that he still felt that condition was a lympho-sarcoma, but that he would welcome any suggestions in the case.

Epithelioma of the Soft Palate. DR. BEAMAN DOUGLAS.

The patient came to the clinic with a history of sore throat. Examination showed the soft palate superficially ulcerated and no visible induration, but when the growth was felt with the finger there was a slight elevation of the mucous membrane but not the muscular tissue of the soft palate. The man also gave a history of syphilis, but his blood was negative. A piece of the growth was removed for examination, and to our surprise a diagnosis of epithelioma was returned.

Dr. Douglas said he had never before seen such a case. The growth was entirely superficial and very extensive, though there had been very little destruction. He was still inclined to doubt the diagnosis, although the specimens were positive. The case was also tested for lupus, but that, too, was negative.

The patient had received mercury and potassium, and the case still seemed doubtful although the diagnosis was fairly positive.

DR. HARMON SMITH said that in 1904 he had presented before the Section a case of epithelioma of the soft palate upon which he had operated three times, using the actual cautery around the border line of the incision. It appeared first at the junction of the uvula with the lateral palatal fold. A wide incision was made to circumscribe the growth; it recurred shortly and was again removed; and then a third time it recurred—all within a period of eighteen months, necessitating the removal of the whole of the soft palate, a part of the hard palate, and the lateral pharyngeal wall. The case was watched for three years and there was no further recurrence during that time. The man was a cooper by trade and was in the habit of blowing into the bung hole of his barrel to see if it was air tight; the removal of the palate interfered with this as the air would all come out through his nose; but ultimately nature intervened and hypertrophied the tips of the posterior turbinates so that they acted as a stop valve and the man was able to follow his vocation as before.

Clicking of the Nose. DR. D. BEAMAN DOUGLAS.

The doctor said he would have liked the members to see this case, since in his experience it was a very unusual one, but the patient was too neurasthenic and too psychic to make it advisable to present her. She was a neurotic person who presented herself with a history of having had a septum operation perfectly performed by a New Jersey specialist three years previously. It was one of the best results he had ever seen, and the convalescence was normal. Three months after the operation the patient

noticed a clicking sensation which she referred to her nose, and this had continued for three years when she came under observation. The patient was examined for the usual causes of such troubles, contacts in the nose, etc., but nothing could be found to account for the sound which was distinctly audible. It was a very curious sound; most of these clickings are subjective and can be felt by the patient only, but this could be heard by others and was something like the sound made by suddenly opening the lip.

The patient being a neurotic individual, it was thought that the sound might come from the contraction of the palate, so a palate retractor was used to draw the palate forward, and the patient asked to stop breathing while it was still drawn forward—but the clicking could still be distinctly heard. It could not be located anywhere in the nose, excepting that it seemed to come from the back part of the nose. Finally on looking through the nose, which was rather spacious, a pulsation of pharynx wall was noted which corresponded fairly well with the clicking. Dr. Douglas observed the pulsation and both he and the patient heard the simultaneous clicking.

Never having seen such a case before he referred the patient to a practitioner for a general examination and he reported every organ normal. This man also made various tests, and he also decided that the trouble was in the nose and attributed it to the operation which had been performed—which, however, Dr. Douglas ruled out.

The woman being neurotic and anaemic, she was put upon a regimen of gymnastics, exercise, diet, etc., and the condition improved within two months, but that was too rapid an improvement to be attributed to diet and exercise. The clicking has now disappeared, but the pulsation is still present in the naso-pharynx and can be seen through the nose.

Dr. Douglas repeated that he was completely at a loss to account for the peculiar symptoms.

Sinking of the Bridge of the Nose following Submucous Resection: One Case Corrected by a Plastic Operation. DR. THOMAS J. HARRIS.

The whole subject of sub-mucous operations—the advantages, and the complications—have been stated in the extensive literature of the subject by such men as Freer, Killian, Ballenger, and others. This case presents no new features, but a new generation having grown up since the operation was originally described, and also for the sake of those who may have forgotten some of the discussions, it seems not out of order to present two cases which have proved of considerable interest at the Post-Graduate Hospital. One of the patients is a young man, the other a young girl, each of them having had a resection of the septum before coming to clinic. One was seen four weeks after the operation, the other three or four weeks. The histories are definite and clear. We tried to shake the history in each instance but could not do so. In each case, immediately following the operation there was a distinct, manifest sinking of the cartilaginous portion of the septum.

Many have thought that excepting in children the operation could be performed with virtual impunity, yet if we consult the statements of Freer and others there is a distinct caution that however much the cartilaginous septum is attacked there should be left a support of variable extent directly under the bridge of the nose. In each of these cases that rule has been disregarded. In one case, while considerable cartilage was left, it was left altogether free from the ridge wall. The young woman complained only of the cosmetic appearance. In her case a plastic operation has been performed. We took part of the shin bone and placed it in the nose something over a month ago and, as you see, obtained a very good cosmetic result. The young man did not come to us on account of the cosmetic appearance, however, but because since the operation he had difficulty in breathing through his nose. It is somewhat difficult to understand this, but he persists that he has it and that it is of a different nature from what he had before.

These cases are presented simply to show that occasionally there can be a sinking of the nose following a submucous operation that has been apparently properly performed, and that from the observations of Freer, Killian and others the caution to leave a cartilaginous support here is very well founded.

DISCUSSION.

DR. CARTER said that Dr. Harris had opened up a subject of too much importance to be fully discussed in an evening with so much else on the programme, but that it was certainly one requiring the most careful consideration. He himself had operated on no less than a dozen of these cases where the sinking of the dorsum of the nose was due to an improperly performed submucous operation. A good many years ago he had drawn attention to the anatomical fact—and had emphasized it very strongly—that the upper edge of the cartilaginous septum is the keystone of the arch and if this were dislocated there would very shortly be a falling in of the cartilaginous dorsum of the nose. He had presented no less than five such cases before the Section, some having been operated upon by well known men. In one discussion of this subject the point was made that the sinking of the nose was due to an infection at the time of the operation and that the cartilaginous ridge had been destroyed by the infection—but that is not the case. Enough of these cases have been observed to know that it occurs because the upper edge of the septum has been displaced during the operation. Dr. Carter said he had always opposed the use of any instrument that would cause any traction on the septum, and had devised one for punching out the tissue so that there might be no traction. He does not approve the use of the swivel knife of Ballenger because it causes traction either downward and backward on this ridge. As soon as the keystone is removed from its position the nose falls in. The falling in is not due to its being pulled out entirely or to its being destroyed, but to its being displayed. The patient's condition is really worse when this falling in occurs than when the mere nasal obstruction existed; for when the ridge falls in there is a folding in of the tissue at the point corresponding with the junction of the upper and lower lateral cartilages which not only causes a mechanical obstruction but it has weakened the resiliency of the structure and so increases the obstruction. The only way to correct that is to raise the tip of the nose, and the only way to do that is to transplant bone.

DR. HARMON SMITH said that he thoroughly agreed with Dr. Carter up to a certain point, and not later than that afternoon had called attention of the students at the Manhattan Eye, Ear and Throat Hospital to the statement just emphasized by Dr. Carter, that the cartilage of the septum projects up between the lateral cartilages of the alae and that dislocation of this cartilage of the septum invariably results in a depressed deformity, which will increase as the fibrous elements increase within the lumen of the nose and pull the outside downwards.

Where obstruction occurs there is no need of injecting paraffin, for it will not overcome the valve-like process of the collapsible alae; but paraffin will overcome the external deformity, and there is no need for a major operation for its control. It only requires a few drops of the paraffin to correct these slight deformities, but to overcome the valve-like condition Dr. Carter's method is right.

DR. UNGER inquired whether it is not possible to tell before operation whether or not a given nose would be liable to this deformity—certain types of noses where there is a tendency to concavity at the junction of the cartilaginous and bony portions and the alar cartilages do not meet at the upper ends. If such a nose were to be operated upon, would it not be well to take extra precautions against a deformity resulting.

DR. GOODMAN said that he understood the case was one of sinking of the tip, not the bridge of the nose. The sinking of the tip he believed to be due to the removal of the entire end of the lateral cartilage. Unless the cartilage is very much deformed it is not necessary to take out the

whole of it, and the portion which remains going from the crest of the maxillary bone to the tip of the nose will keep the tip from sinking. Unless that portion is so deformed that it projects at the vestibule. In such cases he had overcome the trouble by taking out the cartilage and replacing it between the dissected flaps. In two instances it grew in and gave sufficient support for the tip of the nose, so that there was no sinking.

DR. HARRIS, referring to Dr. Unger's question said that Dr. Carter had very clearly explained the anatomical relations. It was true, however, that where there was a tendency to flat nose or a nez retroussé, one should be more careful to avoid errors in the technique. The case was not a sinking of the tip of the nose, but of the bridge.

A Case Showing the Cosmetic Result of the Killian Operation for Disease of the Frontal Sinus. DR. THOMAS J. HARRIS.

This patient is presented purely for the purpose of demonstrating the cosmetic result of the Killian incision—prompted by the presentation last month of a patient by Dr. Coakley and his statement that in his hands the Killian incision had proved so unsatisfactory that he had abandoned it in favor of a much higher incision above the eyebrow.

Experience in his own cases had shown that properly performed the incision through the eyebrow has been so satisfactory that any other is not necessary. This operation was performed two years ago and it is only with difficulty that one can perceive the scar. It therefore seemed to him wise to continue to serve the Killian incision since experience does not seem to demand a substitute.

Adhesions After Tonsillectomy. DR. THOMAS J. HARRIS.

This little boy is presented for examination and for an expression of opinion in regard to the proper operation to be performed. The case is an illustration of a poorly performed tonsillectomy. He came to the clinic a month ago with the statement by his father that he was having difficulty in breathing through his nose. There is a very distinct obstruction in the naso-pharyngeal space due to the posterior pillars coming into apposition with the posterior pharynx walls, and it is a question as to what is the proper procedure to enlarge the space. There is a mid-pharyngeal opening, and there is not very much cicatricial tissue so it would seem a favorable case for such an operation as Dr. Nichols advised a few years ago.

DISCUSSION.

DR. HURD said he understood that the statement made was that the condition was due to a bad tonsillectomy, but the condition seemed to be due rather to the adenectomy. He had seen two such cases. The first time he did not know that he had done it. The patient was a woman and a day or two later he noticed that post pillars were drawn up. The some thing happened in a boy. At that time he was using a needle for placing sutures for a tonsillar rim, and he picked up the posterior pillar and sewed it in, and got a good result. Probably this came with the use of the wide curette; the patient strangles and shuts up the space and the operator is liable to tear the post pillars from behind.

DR. CARTER said that in addition to a bad adenectomy there was undoubtedly injury to the posterior pillars for they would not have become adherent to the excoriated pharyngeal wall unless the pillars too had been injured.

DR. HARRIS remarked that the case had been presented for suggestions as to what operative procedure should be followed.

DR. HAYS said that he had seen one or two such cases and the consensus of opinion seemed to be that the usual operation does not do much good. In one case excellent results had been secured by an orthodontic procedure. This child had a very small nose and a very narrow jaw, and if a good orthodontist could take care of the case and spread the jaw it would be surprising to see how much difference there would be in the

space. The child to whom he had referred had been injured at the age of six had now an excellent breathing space at seventeen.

DR. DOUGLAS inquired of Dr. Harris why it should be necessary to do anything to a child who held his mouth shut tight and breathed through his nose during all the time of presentation.

DR. SMITH said that he too had noted that the child kept his mouth shut tight and breathed through the nose while being presented. He then cited a case that had been sent to him from Long Island. The mother stated that the child had never breathed well since the removal of the tonsils and adenoids. Examination revealed an immense amount of scar tissue in both tonsillar areas reaching across the pharynx, and involving both posterior folds. There was considerable tonsil left on one side and an immense mass of scar tissue entirely encapsulated it while the entrance to the naso-pharynx behind the uvula was not large enough to admit a lead pencil. The condition was worse than that of Dr. Harris's patient as the child could not breathe through the nose, while the one presented by Dr. Harris could do so very well.

DR. MCCULLAGH suggested that Dr. Harris might try the procedure devised by Dr. MacKenty for stenosis of the naso-pharynx. He himself had tried it in one instance and had very satisfactory results.

DR. HARRIS expressed his appreciation of the full and frank discussion of the case, and said he was inclined to agree with Dr. Hurd as to the manner in which the injury occurred. A badly performed adenectomy would have done it, and there was evidence of a badly performed adenectomy there. The curette, however, should not be condemned because improperly used, for almost any instrument would do harm if improperly used. He further said that in his opinion it would be better if any additional operation could be avoided, since any operation for atresia is very difficult. The question was raised simply because the child and the father stated that he was not getting enough air. But until he had satisfied himself of that he agreed that the condition had best be let alone. The prospect of accomplishing anything on cicatricial tissue is very discouraging. The case would be studied very carefully, and if it was decided to do anything, the child would be presented again after operation.

Two Cases of Maxillary Empyema of Dental Origin; Alveolar Fistula; Radical Operation. DR. J. L. MAYBAUM, New York.

The difficulty of successfully healing a sinus between the antrum and mouth, prompted me to present these two cases before the section this evening. With few exceptions, these cases are due to alveolar necrosis with antrum involvement or, at least they are cases of permanent sinus following an operation for antrum suppuration, secondary to alveolar necrosis. Rarely a large infected dentigerous cyst lying external to the antrum and secondarily infecting it, may be responsible for the condition.

Ordinarily the problem of healing a fistula of small calibre is not great, as it readily responds to the use of various cauterizing agents, provided the antrum infection had been eliminated; when, however, the sinus is from one-half to three quarters of an inch or more in diameter, our ingenuity may be severely taxed to bring about complete healing. This can only be accomplished by means of some form of plastic operation, together with a radical antrum operation to provide for thorough drainage through the nose. In order to obtain a successful result at the primary operation, it is necessary in the first place, to remove enough of the adveolus, having previously separated the muco-percosteum sufficiently, to allow of easy approximation of the flaps without tension and, secondly, the sutures are to be applied so as to avoid tearing through the flaps.

CASE 1. The patient was referred to me by her dentist last September, with the following history: Seven months previously she had the left second bicuspid and the first molar teeth extracted. From then until the time I first saw her, she had been complaining of more or less constant pain in the left antrum, headache, foul smelling discharge from the nose

and bad taste in the mouth. Patient insists that she had lost thirty pounds during this period.

Examination of Patient: Poorly nourished, anemic individual. Alveolar sinus in the upper jaw (left), circular in outline, half inch in diameter. Thick, purulent putrid discharge flowing from the sinus into the mouth. Probe entered the antrum for a considerable distance to the orbital wall; rough bone in sinus wall. Examination of nose disclosed purulent discharge in middle meatus and on irrigating the antrum through the alveolar sinus pus flowed from the left nasal chamber. Patient received no treatment of any account throughout the seven months. The technique I employed as regards the antrum operation, differed in nowise from the classical Cauldwell-Luc operation, except that the gingival incision was made at a higher level than usual, in order to allow for a fairly good size flap in attempting to close the large fistula. The case still shows a fairly large opening in the lateral nasal wall. Suppuration from the antrum ceased after two or three weeks.

The procedure of closing the fistula consisted of extending the incision through the muco-periostem from the margin of the fistula, in an anterior and posterior direction for a distance of one inch. I then elevated the muco-periosteum on the inner and outer surface of the alveolus, removing enough of the latter so as to readily bring together the two flaps. Black silk No. 4 was used as suturing material. The sutures soon became loose, so that the fistula was as widely open as before the operation. In consulting the literature on the subject, I found the Dr. L. W. Dean of Iowa City had, after many trials, succeeding in devising a method of procedure which resulted in successful closure of these sinuses at the primary operation, in a majority of his twenty-three cases. This method I followed at the second attempt to close the fistula, with complete success. Briefly, the procedure is as follows: If the operation is done at the time of the antrum operation, as it ordinarily should be, the incision for the Cauldwell-Luc is made high up and entirely separate from the incision on the border of the alveolar process. Dr. Dean does the Denker operation. After completing the antrum operation and being sure of excellent drainage through the nose, the alveolar process is attacked. The necrotic process is removed to allow of perfect opposition of the flaps that have been previously lifted from the inner and outer surface. Silk-worm sutures are used instead of silk, as these can be kept cleaner and hold several days longer than silk. At this point a piece of small rubber tube, sufficiently long to allow it to be tucked underneath all the sutures, is placed on the inner and outer surfaces of the alveolar process. Using double armed silk-worm sutures, a sufficient number are introduced from the inner flaps and through the outer, the loops resting on the rubber tubing on the inner surface of the alveolar process, the knots being tied on the rubber tubing on the outer surface of the alveolar process. It is necessary to avoid tying the sutures to tightly, so as not to produce pressure necrosis of the flaps. The alveolas sinus, in the case of my first patient, was completely healed one week after the operation.

The second case presented a far more difficult problem:

The patient, age 38, was first seen by me last July in Dr. Macpherson's service at the Post-Graduate Hospital. Her history differed in no respect from that of the previous one, except that six weeks following the extraction of three teeth from the right upper jaw, her dentist had found it necessary, according to his story, to remove a considerable amount of bone from the alveolar process and the anterior wall of the antrum, because of extensive necrotic process. For a period of four months following this, the only treatment she had received was daily irrigations and packing.

On retracting the upper lip, I found a large defect, circular in outline, involving practically the entire anterior wall of the antrum. The interior of the antrum readily came into view and was found to contain foul smelling, pus and granulations. Because of the extensive loss of tissue, I offered little hope of completely closing the opening.

Under local anesthesia, the interior of the antrum was carefully curetted and a large opening made below the inferior turbinate. I then elevated the muco-periosteum for a distance of three-quarters of an inch to one inch from the border of the large defect and made an incision, as in the previous case in an anterior and posterior direction. The flaps could barely be brought together. As a result of this operation, the opening was reduced about one-third its former size. A second attempt at closing the opening was made six weeks later with further reduction in size. At the present time, examination discloses an opening above the right alveolar process of small dimension (½ inch in diameter) leading into a cavity much smaller than originally and no longer suppurating.

On taking an X-ray of the right antrum recently we discovered the interesting fact that the right canine tooth, the crown pointing upwards, projects into a cavity apparently the antrum. That fact, together with the elevation of the floor of the nose on that side and the fact that on washing through the fistula, at the present time, no water comes through the nose, inclines me to the belief that this originally was a dentigerous cyst.

DISCUSSION.

DR. PRATT inquired about what Dr. Maybaum found when he did the Caldwell-Luc operation. As he understood the case, there was a large opening in the antral wall and the Caldwell-Luc operation was performed, but before that was done the irrigation did not come through the nose. It would seem that the patient had one of two conditions—either a dentigerous cyst or possibly a double antrum. The shadow in the X-ray picture seemed to show a separation in the antrum.

DR. ABRAHAM said that when he first began sinus work he was inclined to be very radical, and performing these operations he had many fistula. After adopting the intranasal operation fistula never occurred except in cases operated upon by the dentist. The dental surgeons are entirely too radical; following their extractions they very often remove a considerable portion of the anterior wall of the antrum. Dr. Abraham said he believed this to be the cause of so many fistula. From March to June, 1919, he had seen five cases operated upon by the dental surgeon and he was amazed at their radicalism. In every one of these cases they had removed portions of the anterior antral wall which was absolutely unnecessary. At present he allows the dentist to extract the diseased tooth only, and then he assumes the charge of the case—curetting whatever necrosis is present, opening the antrum through the inferior meatus in the way he has so often advocated. He does not pack the alveolar wound but allows the soft tissues to collapse and the wound to heal as quickly as possible, using a simple saline solution through the nasal opening and an antiseptic mouth wash for three to five days. It is remarkable how rapidly the tooth wound heals. When a fistula is present, he has for years followed the method of elevating the periosteum from the alveolus, removing the bone, and curetting the flaps. He has never used the ingenious technique of passing the suture through the rubber tubes, but in the first case he has requiring such an operation he intends using this method. Since he had adopted the habit of over-seeing the dental work of his patients, he had seen no fistula, and is convinced that many of these cases are due to the radical work of the dentist.

DR. MAYBAUM said that it must be remembered that the second case was not seen until practically all the pathology had been removed. There was a large opening in the anterior antrum wall, and on irrigating through the opening the solution came through the nose. There was no question of the communication. At the present no such communication can be demonstrated.

As to whether or not the condition was originally due to a dentigerous cyst, he could not definitely say, but he was inclined to this belief from the facts previously stated; that this was very likely an infected denti-

gerous cyst which had either ruptured into the antrum or the communication had been brought about as a result of the over-energetic efforts of the dentist.

Dr. Maybaum expressed himself as being quite in accord with some of Dr. Abraham's remarks regarding excessive dental surgery. Opening into the antrum through the alveolar is undoubtedly at times, unavoidable. We are, however, familiar with cases of antrum suppuration the result of fracture of the alveolus into the antrum. Excessive curettment of the tooth socket accounts for some of these cases. Attempts made to heal these cases with irrigation and packings are of course, to be severely condemned.

DR. BERTRAM B. MACHAT: Concerning the arraignment of the Dental Surgeon by the last speakers, it may not be inappropriate to say a word in justification of the former as seen from the viewpoint of the Oral Surgeon.

The recent occurrence of increasing numbers of sinuses leading from the alveolar socket into the antrum and vice versa is patent to every one concerned in this work. However, only a dispassionate consideration of the underlying etiology will lead to concurrent and constructive discussion. Judging from the points emphasized by Drs. Maybaum and Abrams, it appears, first: that the anatomical landmarks of the part under discussion have been lost sight of by the speakers. It is a well known fact that the apices of the teeth posterior to the cuspid, either approximate or actually intrude the antral floor, being separated only by membranous coverings and a thin layer of cancellous bone. Thus frequently the mere removal of a tooth in this region creates an opening into the antrum of Highmore. Second; and in this I concur with Dr. Abrams, namely, that Dental Surgeons, because of a fuller cognizance of their responsibility are exercising and extending their usefulness to the point of removing diseased tissues. The potentialities of dento-apical infection is now common knowledge and of special interest in this discussion should be the Pathogenesis of dental granulomata and dentigerous cysts, which involve the antra by contiguity.

Dr. Truman Brophy claims that 75 per cent of antral complaints are due to diseased teeth. Other observers have given similar warnings. Substantiating these warnings, my own experience, both in hospital and private practice relative to the incidence of Maxillary Sinusitis, has long since led to the sweeping statement that on no account will I attempt the conservation of a previously infected upper molar. Certainly extraction of teeth is largely on the increase. Is it to be wondered that these sinuses (as characterized by the speaker) are so prevalent? To be sure, this argument does not condone misguided surgery, yet errors of this nature are not limited to the field of the mouth specialist.

However, accidental or incidental opening into the antrum following a dental operation is a sequel of no great moment, since, when lightly dressed, these close up rapidly. Again, where in course of an alveolar curettage an empyema has been discovered, its benefit is manifest. And although opinion differs concerning the most adequate means of drainage, the downward route is, after all, the most favored by pus. In the hands of the Oral Surgeon even the large openings present no problem. A flap operation, and in rarer cases an artificial restoration will readily cope with this aftermath. On the other hand, does Dr. Abrams propose to clear up a refractive sinus trouble which is constantly reinfected by an undisturbed suppurating granuloma via the meatus? Such cases are unfortunately not infrequent, and none the less stigmatizing.

Recognizing the fact that this borderline work is essentially overlapping by the two specialties, is not this an irrefutable argument for closer co-operation of the Rhinologist with the Oral Specialist?

Report of the Tonsil Work at the Post-Graduate Hospital for the Year 1919. DR. BEAMAN DOUGLAS.

During the year 1919 there have been performed at the Post-Graduate Hospital 1560 cases of tonsillectomy, the majority of them being in children between eight and ten years of age. The previous examination for the hospital cases requires a clear chest and clear urine, normal rectal temperature, and good heart.

The special interest of this report depends upon the variety of operators and methods employed. The students are allowed to perform the operations under a competent instructor. There is probably no other institution with such a number of men working representing such grades of efficiency and inefficiency.

There were twenty cases where the tonsils were badly removed; usually a part of the tonsil was left. There was no case of sepsis, no permanent interference with speech, no pneumonia. There was one case of lung abscess, which recovered. The great majority of the patients leave the hospital the next morning.

Hemorrhage is the most common and most serious post-operative condition, and the house-staff are called into the wards to see tonsils where there is bleeding enough for the nurse to send for the physician—in 6.5 per cent of the cases—which, considering the number of operations, is not a large proportion. The house-staff state that in nearly every such case they find mutilated pillars or a piece of tonsil remaining. The bleeding cases were divided as follows:

In ninety cases there was slight oozing from the capillaries; these either ceased without any remedy, or else a cotton pledge placed in the fossa immediately controlled the bleeding; six cases required the application of an artery clamp to the bleeding vessel; one case only required more active measures and this was controlled by suture of the tonsillar pillars over a pledget of cotton.

The bleeding is usually checked by one of three measures: By pressure, as with a cotton ball in the fossa, or with cotton soaked in acetate of aluminum; in a few cases thrombo-platin has been used; this pressure has been applied usually for ten minutes, but in some cases as long as two hours. It is successful in stopping the oozing cases. The second measure to control bleeding is used where there is an active flow of blood —more than the ordinary oozing. These cases are clamped at once with an artery clamp usually without anesthesia. In most of these cases the hemorrhage is either in the upper pole or near the tongue; in almost all the cases the blood comes from the posterior pillar. An artery clamp applied to the bleeding point makes the throat very sore and causes superficial sloughing, so that we avoid this measure whenever possible. If the bleeding still persists a clot is found in the tonsillar fossa, and the hospital rule is never to leave a clot in the tonsillar fossa. The students are instructed to remove it, for the bleeding is behind the clot.

Third measure: If the bleeding continues and has not been stopped by the clamp, the fossa is scraped with the curette and the pillars are sewed together over a pledget of cotton, one of the sutures going through the cotton so that it will not slip out. This method has been necessary only in one case.

In *three* years we have had *four* fatalities. That is not many. In the first there was bleeding, clamping, and a ¼ grain of morphin was given. In the second case, there was bleeding, clamping, general anesthesia and reclamping—and the patient died on the table, of hemorrhage. The third case was a child—bleeding, clamping, and the child died. The fourth case —bleeding, clamping three times, shock and death.

DISCUSSION.

DR. MCCULLAGH inquired what Dr. Douglas meant by clamping.

DR. DOUGLAS replied: putting an artery clamp on the bleeding point.

DR. ABRAHAMS inquired what kind of clamp was used.

DR. DOUGLAS replied that it was a rather large clamp, seven inches long, with two blades.

DR. LEDERMAN inquired regarding the method of operation mostly employed.

DR. DOUGLASS replied that with local anesthesia dissection is used with adults, and that varies with the operator who does the work. Some men use scissors entirely, others the muscle separator devised by Dr. Hurd. Under general anesthesia the favorite operation is some variety of the Sluder method with the sharp instrument to cut the fold of tissue which is crushed and is outside of the tonsillotome. Others methods also are used—the Beck-Muller and other snares. All kinds of operations are employed, but we prefer some form of the Sluder method under ether.

DR. CARTER inquired what method was employed in the case that terminated fatally, and Dr. Douglass replied that he was not able to answer that question.

DR. ABRAHAM asked whether Dr. Douglass ligated the bleeding point during the secondary hemorrhage after applying the clamp. Since he himself had adopted this method at the time of bleeding he had rarely been called upon to see a secondary hemorrhage, and does not now see one-tenth of one per cent of hemorrhages. He makes it a point at the time of operation if the bleeding cannot be checked by pressure, to immediately ligate the bleeding points; he has passed as many as nine ligatures in adult cases, but had never had a secondary hemorrhage. Another point to be avoided is shock following operation in children as well as in adults. As the patient recovers, a hypodermic of codein or morphin is administered, and if necessary, a Murphy drip of soda bicarbonate. A thorough examination before operation, and a proper preparation of the patient for the operation is practiced in all cases.

DR. JONES asked if the cases were re-inspected.

DR. WILLIAM N. HUBBARD said that in his opinion most of the trouble comes from meddlesome interference. At Johns Hopkins they are ligating every case; it is entirely unnecessary. If the operation is quickly and thoroughly performed the danger is very, very slight. During a practice of twenty-five years he had removed a large number of tonsils but he had not had one patient that gave him any great concern so far as bleeding was concerned. He had never found suturing necessary; it prolongs the operation and increases the danger.

DR. DELAVAN emphasized the importance of testing the blood preparatory to removal of the tonsils, as suggested by Dr. Luder of St. Louis. He had employed that procedure for a long time, and every now and then finds that the administration of lactate of calcium preliminary to the operation, as suggested to him by Dr. Thomas R. French, is very valuable. By this means the blood can be brought into a proper condition and much danger thus averted.

DR. WILSON agreed with the last speaker. He does not himself employ suturing, and had also given up taking the blood clotting time, simply noting the bleeding time; and had found that in many cases of severe hemorrhages the patients are not bleeders at all, but the bleeding is caused by injuring the muscular tissue. He has seen very few hemorrhages.

DR. CARTER said that a 6.5 percentage of hemorrhages he considered high. In his clinic at Gouverneur Hospital he averaged about 40 cases a week, year in and year out. Last Fall the House Surgeon collected the statistics, showing something over 3,000 cases with not a single death from hemorrhage, and in all these cases he did not have a single alarming hemorrhage following a tonsillectomy. He used the Sluder method generally, but in the case of adults the snare is frequently employed. All

his patients report for examination one week after operation. He believed that such an experience as this shows that the precaution of suturing the pillars in every case is entirely unnecessary.

DR. HURD said that some years ago he gathered reports of 15,000 cases operated upon by a little better class of men than those mentioned by Dr. Douglas, and out of that 15,000 cases there were six deaths reported, two of them being due to status lymphaticus; the other cases were hemorrhages. . . . There were 10 per cent primary and 5 per cent secondary hemorrhages. There was an astounding percentage at that time, of not clean tonsillectomies. Dr. Douglas' results were certainly better than this report of some fifteen years ago.

DR. LEDERMAN said that many of these cases that were operated upon were not seen later by those who operated. Recently four cases of secondary hemorrhage had come to Lebanon Hospital that had been operated upon in other Manhattan hospitals.

DR. HARMON SMITH said that the statistics from the Post-Graduate Hospital represented a very small proportion of the tonsillectomies done in the city, but he considered the report very favorable. At the Manhattan Eye, Ear, and Throat Hospital, during 1918 there were 4,600 tonsillectomies performed. There also the post-graduate students do a large number of the operations, but there is a routine for the control of hemorrhage and very few serious hemorrhages occur considering the number of different operators and the variety of technique employed. A regular routine for the control of hemorrhage is employed—as tannic and gallic acid paste, thrombo-plastine, or thrombo-kinase, and if these are not effective a metal suture is employed, though it has not been found necessary to use more than two of these on a side. Sometimes hemorrhages occur in bleeders, not necessarily hemophiles, and it is here necessary to give horse serum or even human serum. In private practice he gives children calcium lactate, 20 grains t. i. d. for 3 days previous to operation, and to adults he gives in addition 20 grains of sodium bromide t. i. d. for 3 days. One-half an hour before the operation under local anesthesia, he gives ¼ grain of morphin to adults. Up to the present time he has not had a case of hemorrhage following the removal of tonsils in adults under local anesthesia.

DR. DOUGLAS, in closing the discussion, said that coagulation tests are not made in the hospital as a matter of routine, but are made by any operator if he wishes to do so. It requires some time and it is not necessary for every case. Where one uses a suture or a ligature, one has to use a clamp, and that causes superficial necrosis and prolongs the convalescence. As for re-inspection, the patients usually return for observation until cured. If there were any appreciable number of pneumonia cases occurring they would be detected, for the hospital is very watchful about that. He would only suture the pillars over a cotton pledget placed in the fossa as a last resort, when the bleeding could not be stopped by any other method.